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Broaden your Views.
Implicatures of Domain Widening and the “Logicality” of Language

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Broaden Your Views:
Implicatures of Domain Widening and the “Logicality” of Language*

1. Introduction.

Over the past few years there has been substantive progress in our understanding of the semantics of Negative Polarity Items (NPIs).¹ There have also been (quite recently, in fact) important steps forward in the analysis of Free Choice Items (FCIs).² As is well known, a strong link exists between these two types of Polarity Sensitive Items (PSIs). Robust typological considerations point in that direction. According to Haspelmath (1997) roughly half of the approximately 150 languages he surveys employ the *same* morphemes for both NP and FC uses of Polarity Sensitive Items (PSIs), English being among them. The other half employs different series for the two uses; as is the case in Romance. If for such seemingly diverse functions, the same morphemes are selected in so many unrelated languages, the link between those functions cannot be accidental. FCIs and NPIs must form grammatical classes that while not identical have a deep systematic relationship to one another. However, the exact nature of such relationship remains the object of an intense debate which hasn't reached as of yet firm conclusions (see, e.g., Horn 1999 for a critical discussion of various positions). Here is, for example, an outstanding puzzle. There are NPIs like *mai/ever* that (together with minimizers and n-words) disallow free-choice uses; and there are FCIs like *qualunque* in Italian that disallow negative polarity uses; in contrast with this, there are words like *any* have both NP- and FC-uses. How come? Let P1 be the property that characterizes NPIs which disallow FC uses (*mai*) and P2 the property of FCIs that disallow NP uses (*qualunque*). Such properties must be incompatible: having P1 (being an NPI like *mai*) must entail not having P2 (being a FCI like *qualunque*). Obviously, then, we cannot say that *any* has *both* P1 *and* P2, for such properties are incompatible. We could say that *any* can have either property. This tantamounts to saying that *any* is ambiguous. But as we know from Haspelmath's survey, roughly one language out two is like English: it has PSIs that do double duty. So the equivalent of *any* is lexically ambiguous in every second language. And which other lexical ambiguity works that way?

The present paper is an attempt to contribute to this ongoing debate with a precise hypothesis on the semantics and syntax of NPIs and FCIs. Building on the work quoted above, our main claim is that Domain Widening (DW), properly construed, does indeed constitute a unifying basis to understand PSIs. It also turns out that DW (through the role it plays in the grammar of PS relations) also constitutes an important source of insight on the

* Acknowledgements: to be written.

¹ I have in mind, in particular, Kadmon and Landman 1993, Krifka 1995, Lahiri 1998. For background, see references therein.

² See especially Dayal 1998, Kratzer and Shimoyama 2002, and, for relevant background and alternatives, c.f. also references therein.

relationship between pragmatics and the computational system of grammar and on long standing puzzles like intervention effects.

In the remainder of this introduction, I will flesh out informally the main issues surrounding these questions and discuss in what ways they are of interest for the architecture of Universal Grammar.

The DW hypothesis, since first put forth about a decade ago in Kadmon and Landman (1993), has been the main semantic insight around which current investigations of PSIs revolve. The intuition behind it is the following. It is well known that as we communicate, we select domains of discourse as our subject matter. Non referential DPs like *every student*, *a student*, *some student*, etc. are used with such domains in mind. For example when we say “some student doesn’t know me” we mean something like “some student in D” (or “some student_D”, for short), where D is a set of individuals salient in the context of use (e.g. students on this campus/city/country/etc.).³ What Kadmon and Landman propose is that NPIs are indefinites (with a core semantics similar to that of *some student* or *a student*) which contain an instruction to consider domains of individuals broader than what one would otherwise do.

- (1) a. a/some student_D
 b. any student_{D+}
 where $D \subseteq D+$

If use of a plain indefinite *a/some student* would have naturally lead to focus on some salient domain D (say, the students around here) use of *any student* invites one to consider a set possibly larger than D along some relevant dimension, with the inclusion of cases that might have otherwise been considered marginal (say, visiting students, students on leave, or what have you). This rather simple idea has the potential for explaining why NPIs like being in “negative” environments. Consider a typical contrast:

- (2) a. *There is any student_{D+} (in that building)
 b. There isn’t any student_{D+} (in that building)

In a positive context, like (2a), widening the domain of an existential leads to a statement which is *weaker* (i.e., less informative) than what we would obtain with a plain indefinite. Suppose, for example, that the set of new students is salient and that we would, therefore, be thinking of them in uttering “there is a student in that building”. Then, if our utterance is in fact true, that remains so for any larger domain (say, one that contains new or old students). So what could be the point of widening the quantificational domain in such a case? If you are willing to accept an existential statement over some domain D, you should be ready to accept it for any broader domain. Domain widening seems purposeless in positive contexts.

Things are very different within the scope of negation. In such a case, consideration of a broader domain leads to a stronger (and hence more informative) statement. For example, it may be used to convey, that if you were focusing on new students, not only there isn’t anyone of those around; but also old students aren’t around: there simply isn’t ANY student (new or old) around. This is a sensible thing to do; in fact, it is a linguistic move we know we can make in more than one way (cf. “There wasn’t a single student” or “There weren’t students at all”, etc.). So, we see that DW provides us with a natural “functional” basis for explaining the contrast in (2).

³ A standard reference in this connection is Westertahl (1988)

The appeal of this line of explanation can perhaps be appreciated as follows. It had been discovered in the 70s that NPIs often like being in contexts which share a certain, rather abstract property with negation (namely, Downward Entailment: the capacity to license inferences from sets to subsets: John is not a smoker entails John is not a Muratti smoker, etc.). Now we have a simple hypothesis on the communicative function of NPIs (namely, DW) which makes us readily see why such items would want to be used in DE contexts. Only there they seem to serve a reasonable communicative practice: maximize information content with parsimonious use of resources.

This insight, of course, has to be turned into a “real” grammatical constraint: how does one go from basic “functionalistic” intuitions based on DW to actual grammatical conditions, viz. pieces of the computational system (that, say, rule things like (2a) out and things like (2b) in)? There is disagreement on how to accomplish that. Kadmon and Landman stipulate a construction specific semantic/pragmatic constraint that limits DW to occur only in contexts where it leads to strengthening (in a sense, they try to make it part of the lexical meaning of *any*). Krifka, instead, links DW directly to quantity implicatures. An NPI activates alternatives with smaller domains; this triggers an implicature, in accordance with Gricean principles, that the alternative selected is the strongest the speaker has evidence for. Lahiri proposes instead that the alternatives associated with NPIs play a role similar to the one they play in focus semantics (cf. Rooth 1985); more specifically, NPIs have as part of their lexical meaning something that resembles the meaning of the focus particle *even*. “Even John drank” indicates that John was the least likely person to drink. An indefinite with a widened domain does the same. “There is(n’t) any student” indicates that the presence/absence of a student in the widened domain is the least likely possibility to be actualized (which can be sustained only in DE contexts).

The key issue that arises in this connection is: how does the pragmatics of communication interact with specific lexical/grammatical conditions that license the presence of certain items in certain structures and not in others? How come pragmatically driven conditions, which usually can be overridden, give rise in the case at hand, to unsanable grammaticality contrasts such as those in (2)? Through PSIs, one can hope to learn more on this fundamental question

Recently, Kratzer and Shimoyama (2003) have argued that DW may play a role also in the analysis of FCIs. They study in particular the German FC indefinite *irgendein*. One of its canonical uses is illustrated in the following example:

(3) Ich werde irgendein Doktor heiraten.

I will a whatsoever doctor marry ‘I will marry any doctor’

Intuitively, (3) indicates that I intend to marry a doctor, and that I am not choosy at all as to who that might be: any doctor whatsoever is a possible option. Kratzer and Shimoyama propose that this too might be an implicature triggered by DW. They argue that strengthening is not the only reason why one might want to widen a certain domain. Extreme uncertainty and hence reluctance to rule out even the most far fetched possibility might be another sensible way to exploit DW. By telling you that the indefinite ranges over a wide domain I signal to you my intention not to rule any conceivable option out. Whence the FC interpretation that any doctor is an option. This line of reasoning insightfully extends the DW idea to FC uses. And it also raises questions parallel to those we encountered in our brief discussion of the grammar of “pure” NPIs. How can pragmatic,

conversation driven processes determine strict morphosyntactic patterns? And what is the relation between two so apparently different uses of DW?

Against this general background, there are more specific issues in the grammar of FCIs that stand out as particularly controversial and that may play an important role in making our understanding move forward. One concerns their relation to modality. FCIs seem to be felicitous basically in presence of (certain kinds of) modals; even when such modals are not overtly present, some kind of modality seems to be required to attain interpretability. Take for example the following German example:

(4) Gestern hat irgendein Student für dich angerufen

Yesterday has a student whatever for you called

Even though this is clearly an episodic sentence, it indicates that the speaker doesn't know or doesn't care about the identity of the caller. So (4) requires the presence of a covert epistemic modal of some sort for its interpretation. Consider, by the same token, the following typical example of a FC use of English *any*:

(5) Yesterday Mary saw any student that wanted to see her

Sentence (5), like sentence (4), is episodic (*not* modalized by anything like an implicit generic). Still such a sentence seems to invite counterfactual conclusions: If, say, Joe would have fancied to see Mary, she would have seen him; this effect is subtly but robustly more there with *any*, than with its cousin and near synonym *every* (see Dayal 1998 for arguments). Where does this implicit modality come from? Why does it patterns in such peculiar ways?

A related issue concerns the quantificational force of FCIs. German *irgendein* appears to be definitely existential. Sentence (2) above indicates my willingness to marry one doctor; and sentence (3) indicates that just one student called. In contrast with this FC *any*, as exemplified by sentences like (5), appears to be definitely universal. If one student wanted to see Mary and didn't, sentence (5) would be false.⁴ At the same time, even FC *any* (which is so clearly amenable to being understood universally) appears to acquire an existential flavor in certain contexts. As Giannakidou (2002) observes, imperatives are one such context:

(6) To continue push any key

A sentence like (6) does not, typically, constitute an instruction to push all keys.

Summing up, there is host of intriguing, open questions surrounding polarity sensitivity. The main ones we intend to pursue are the following:

- (7)
 - a. Can DW constitute a semantic insight capable of unifying all cases of Polarity Sensitivity (from NPI to FCIs) ?
 - b. Can DW, in particular, explain how come different types of FCIs vary in their quantificational force and in their link to modalities?
 - c. DW based accounts are always pragmatically driven. What can we learn from it on the relation between the computational system and the pragmatics of communication?

The present paper is organized as follows. In section 2 we identify more explicitly the pattern of FC constructions in Italian, which will bear out and justify the claim that

⁴ The universal character of English *any* is argued for more extensively in Dayal (1998). Similar arguments have also been developed for FC in Scandinavian by Saeboe (2002).

there are at least two types of FCIs, an “existential” one and a “universal” one, with distinct scope properties. This pattern will provide us with a rich testing ground for the hypothesis to be developed. In sec. 3, we will present some background assumptions on the role of implicatures in grammar. In section 4, I discuss NPIs. In section 5 and 6 the two types of FCIs, “existential” and “universal” are dealt with. Section 6 provides some tentative general conclusions. Formal details are worked out in the Appendix.

2. Some Italian data: Two types of FC items.

Italian (and, more generally, Romance) turns out to be a good language to address the issue of quantificational force of FC elements, for it has two related but clearly different such elements. The first is [*un N qualunque/qualsiasi*], which closely resembles German *irgendein*. The second is [*qualunque/qualsiasi N*], which resembles more closely FC *any*. They clearly contrast in quantificational force. Here is a minimal pair:

- (8) a. ? Sono uscito in strada e mi sono messo a bussare come un matto ad una porta qualsiasi con i battenti in legno.
(I) went out on the street and started knocking like a maniac at a door whatever with wooden shutters
b. Sono uscito in strada e mi son messo a bussare come un matto a qualsiasi porta con i battenti in legno.
(I) went out on the street and started knocking like a madman to whatever door with wooden shutter

Sentence (8a) is somewhat marginal; however, it can be interpreted if we imagine a context in which the agent goes out without knowing what to do and acts upon a door selected randomly; in such a (semi modalized) context, (8a) interpreted existentially: I knocked to one door. The modifier *con i battenti in legno* ‘with wooden shutters’ can readily be construed in a non restrictive manner. Sentence (8b) is understood, instead, universally (I knocked to all doors with wooden shutters), and the modifier is construed restrictively. The existence of different constructions (ultimately involving different lexical items) with different quantificational forces clearly needs to be understood better: If DW is systematically involved in FCIs, how can it give rise to such diverse effects?

Schematically, the form of FCIs in Italian is the following:

- (9) a. [INDEF NOUN FC]⁵
un dolce qualsiasi/qualunque
a sweet whatever
due dolci qualsiasi/qualunque
two sweets whatever
.....
b. FC NOUN

⁵ The order [INDEF FC NOUN] is also found:

- (a) un qualsiasi/qualunque uomo
a whatever man

However, in such order, the only possible realization for INDEF is the indefinite article. Numerals are disallowed:

- (b) * due qualsiasi uomini
two whatever men

I don’t know why this is so.

qualunque/qualsiasi dolce
 whatever sweet

The constructions in (9a) vs. (9b) probably are syntactically related. But I won't attempt any serious analysis of their syntactic structure here. From a semantic point of view, such constructions have a common core (which we will try to bring out). However, as pointed out above, they also clearly differ in quantificational force, with (9a-b) interpreted existentially and (9c) interpreted way more universally (if one may say so). We have illustrated this for episodic contexts (i.e. (8) above). Under modals, we get a similar pattern (with one *distinguo*, as we will directly see).

- (10) i. Future
- | | |
|---|------|
| a. Domani interrogherò qualsiasi studente che mi capiterà a tiro | ∀, ∃ |
| tomorrow I will interrogate whatever student that I will lay my eyes on | |
| b. Domani interrogherò uno studente qualsiasi | ∃ |
| tomorrow I will interrogate a student whatever | |
- ii. Imperative
- | | |
|------------------------------|------|
| c. Prendi qualunque dolce | ∀, ∃ |
| Take any sweet | |
| d. Prendi un dolce qualunque | ∃ |
| Take a sweet whatever | |
- iii. Modals of possibility
- | | |
|-------------------------------------|----------|
| c. Puoi prendere qualunque dolce | ∀, ∃ (?) |
| You can take any sweet | |
| d. Puoi prendere un dolce qualunque | ∃ |
| You can take a whatever sweet | |
- iv. Modals of necessity
- | | |
|---|----------|
| e. Devi prendere qualunque dolce con il liquore | ∀, ∃ (?) |
| You must take any sweet with liquor | |
| [∃-favoring context: If you go to Naples, you must go to Scaturchio] | |
| f. Devi prendere un dolce qualunque con il liquore | ∃ |
| You must take a whatever sweet with liquor | |

Take a sentence with [*qualsiasi N*] like (10a). It uncontroversially admits a universal reading: (10a) can readily be used to express my intention to see all students. However, within the scope of a modal (unlike what happens in episodic contexts such as (8) above), [*qualsiasi N*] also seems to admit of an existential reading. E.g., I can also use (10a) to express my intention to interrogate just one student. With some modalities (e.g. with imperatives) this ambiguity is very clear. In other cases (e.g. in (10e)) the universal reading seems to be favored and a special contexts might be called for in order to get the existential reading.

So, there is a sharp and systematic contrast between [*qualsiasi N*] and [*un N qualsiasi*] structures. The former always admits of a universal reading; however, in the scope of an overt modal, it also seems to be able to get an existential reading (at least, often enough). The latter is always existential and gets interpreted universally, if at all, in highly marked circumstances.

From now on, I will reserve “existential FCIs” to the structures in (9a), while I will use “universal FCIs” for those in (9b). These are intended as descriptive labels (without prejudging the analysis).

Another interesting difference between existential and universal FCIs concerns what has come to be known as the “subtriggering” effect,⁶ illustrated by the following paradigm.

- (12) a. ?? Ieri ho parlato con un qualsiasi filosofo
 b. ?? Ieri ho parlato con un qualsiasi filosofo che fosse interessato a parlarmi
 c. ?? Ieri ho parlato con qualsiasi filosofo
 d. Ieri ho parlato con qualsiasi filosofo che fosse interessato a parlarmi

Sentence (12a), in which the existential FCI appears unmodified, out of the blue is marginal (unless we are in special contexts); the addition of a relative clause, if anything, makes things worse (12b). Also the universal FCI, when it appears unmodified is marginal (unless we are in special contexts); however, the addition of a relative clause makes it completely acceptable. A modifier seems to restore full grammaticality for universal FCIs in episodic sentences. No similar effect is detectable with existential FCIs.

Also telling is the interaction of Italian FCIs with negation, as it reveals further scope differences between the two types of FCIs. A sentence like (13), for example, where negation has scope over a universal FCI, typically is only acceptable with the special intonation associated with the so called “rethorical” reading.

- (14) Non leggerò qualunque libro
 (I) won’t read whatever book

Sentence (14) says that it is not the case that I will read every book (i.e. $\neg \forall$) and suggests that I am going to read some special one. If we add a modifier and make the FCI more heavy (i.e., perhaps, more topical), things change. The rethorical “not just any old one” reading remains possible. But next to it, a novel one appears:

- (15) Non leggerò qualunque libro che mi consiglierà Gianni
 (I) won’t read any book that John will recommend to me

Sentence (15) can also express that I simply won’t read any book suggested by Gianni (i.e. a $\forall \neg / \neg \exists$ reading).

So universal FC items, at least in certain cases, display a scopal ambiguity vis-à-vis negation. In contrast with this, an existential FCI embedded under negation only has the rethorical reading:

- (16) Non leggerò un libro qualunque (che mi consiglierà Gianni)
 (I) won’t read a book whatever (that John will recommend to me).

Sentence (16) can only mean that I won’t read any old book (recommended by Gianni). This fact is particularly interesting as it differs from what Kratzer and Shimoyama report on German *irgendein* (which is otherwise so similar to Italian *uno qualunque*). Under negation, German *irgendein* is ambiguous between a rethorical and a non rethorical/NPI-like reading (as it happens with (15) in Italian). Anyway, on top of this interesting crosslinguistic contrast, we see that in Italian universal and existential FCIs display a differentiated behavior under negation, whose rationale one would like to understand.

Thus Italian FCIs form a rather interesting and in certain regards puzzling pattern, which enables us to integrate the generalizations so far put forth in the literature. In particular, the existence (in fact, co-existence) of two kinds of FCIs (contrasting in existentiality vs. universality) with distinct scopal properties seems to be empirically supported. The interesting theoretical question is how exactly these two types of FCIs are related to each other and to other polarity phenomena.

⁶ This terminology is taken from LeGrand (1975)

3. Background: Pragmatics in Grammar.

As pointed out in the introduction, the semantically based approaches to Polarity Sensitivity we are considering all appeal to pragmatics, in some form or other. The problem that arises in this connection is how pragmatic and morphosyntactic processes interact with each other in a modular system. With respect to such problem, I will be assuming that certain pragmatic processes (i.e. processes involving speaker's intentions and other aspects of the conceptual/intentional system) are visible to (and accessed by) the computational system. More specifically, (some) implicatures are computed recursively and compositionally, on a par with ordinary meaning computation (and aren't, therefore, part of a postgrammatical process). The main motivation for such an assumption, in a nutshell, is twofold. First, NPI licensing can occur at any level of embedding. If implicatures play a role in such licensing, they must be computed at the relevant embedded site, on a par with compositional semantic processes and other cyclic (or phase driven) syntactic processes. Second, scalar implicatures play a key role, I claim, in certain grammaticality judgments (e.g., those related to so called intervention effects –cf. below sec. 4.3xx); if so, then scalar implicature computations must be part of (or accessible to) the computational system of UG.

An early approach to pragmatics along these lines was developed by Gazdar (1979). Recently, similar ideas have been revived in work on “maximization” (Landman 1998) and other Scalar Implicatures (Chierchia 2004).⁷ Some general consequences of these views for modern pragmatics are addressed in Recanati (2003). The approach to Polarity Sensitivity to be developed here has to rely on frameworks of this sort. For explicitness sake I will now outline a compositional system of Scalar Implicature (SI) calculation, as an example of “recursive pragmatics”. I will do so in informal terms, leaving formal details to the Appendix. The system I will present is a slight (?) modification of the one developed in Chierchia (2004). It should be born in mind that what follows is provided primarily for illustrative purposes and can/should be modified in more than one way.

3.1. Recursive Pragmatics.

Each expression (or rather, its LF representation) is associated to its meaning/denotation in familiar ways. For example, (17a) is interpreted, say, as in (17b):

- (17) a. many of your students complained
 b. \parallel many of your students complained \parallel = many_D (of your students)(complained)

I use logical formulae as stand ins for the corresponding denotations (cf. Appendix xx). The inferential process through which the (canonical scalar) implicature arises, according to the familiar Gricean proposals, is often characterized along the following lines:⁸

- (18) a. some of your students complained
 b. many of your students complained
 c. all of your students complained

i. The speaker chose to utter (b) over (a) or (c), which would have been also relevant

⁷ A bibliographical remark. The basic ideas in Chierchia (2004) have been first elaborated in 1999 (and presented at a series of workshops, etc.); a written form essentially identical to the published version has been circulating since 2001.

⁸ This is, of course, directly inspired by Grice (1989). Cf. also Horn (1989).

- ii. (c) entails (b), which entails (a) [the quantifiers form a scale]
- iii. Given that (c) is stronger than (b), if the speaker had the info that (c) holds, she would have said so [quantity]
- iv. The speaker has no evidence that (c) holds
- v. The speaker is well informed on the relevant facts

Therefore:

- vi. The speaker has evidence that is not the case that (c) holds

Notice that the last step, unlike the previous ones, is not readily justifiable on the basis of Grice's maxims and (pure) logic. It seems to require a "leap of faith" about the information state of the speaker. Such a leap, called by Suaerland 2005, the *epistemic step*, tantamounts to a sort of neg-lowering, i.e. pushing negation across an epistemic modal (from *not has evidence that* to *has evidence that not*). This step is crucial in deriving SIs and will also play a key role below in deriving the implicature characteristic of FCIs.

It is evident that the process in (18) does not consciously take place whenever an implicature comes about. Rather, it seems to be automatic and unconscious in hearers/speakers just like so many other aspects of semantic interpretation. This suggests that it may be wrong to limit processes of this sort to root sentences. It is true that the reasoning in (18) concerns the effects of *utterances*. But embedded clauses are, after all, potential utterances. And surely speakers do routinely work out the possible conversational effects of potential utterances. So it is conceivable that we run through a process like (18) in a cyclic manner, computing the "utterance potential" of embedded clauses compositionally. I will pursue here this idea, by assuming that there are operations that "enrich" basic meanings and freely take place at scope sites. Such operations (together with certain assumptions on functional application) constitute the core of recursive pragmatics.

A crucial part of (18) is the observation that a sentence is typically considered against the background of a set of alternatives. Once the alternative set (e.g. 18a-c) is salient to illocutionary agents, choosing a particular sentence out of it is going to be per se informative. Krifka xx speaks, in this connection, of "motivated interpretation of alternatives", typically guided by the awareness that one could have made weaker or stronger assertions. In particular, scalar items seem to automatically activate the alternatives constituted by their scale mates. Uttering (17a) brings spontaneously to salience the alternatives in (18a-c). It is as if we compute alternatives in tandem with the basic meaning of a scalar item. We can imagine a function $\| \cdot \|^{ALT}$

that associates with any item its scalar alternatives. For example:

- (19) $\| \text{many of your students complained} \|^{ALT} =$
 $\{ \text{some}_D(\text{of your students})(\text{complained}), \text{many}_D(\text{of your students})(\text{complained}),$
 $\text{every}_D(\text{of your students})(\text{complained}) \}$

Surely such a set of alternatives is computed through the same operations we use to compute plain meanings. In fact, this can be done just like in alternative semantics for questions (Hamblin 1973) or focus (Rooth 1985, 1992). And something like (19) can, accordingly, be thought of as specifying one of the questions/issues under discussion, namely the question "roughly how many of your students complained?"

Alternatives keep growing until they are factored into meaning by some operation that produces pragmatically enriched interpretations. In the case of scalar alternatives, such an operation can be characterized rather simply. The alternatives in (19) are *linearly* ordered by entailment (and hence, informativeness), i.e. they constitute a scale. Against this

background, the pragmatic reasoning considered above in (18), including the epistemic step, yields that the alternative the speaker picks (and its entailments) is the *only* one s/he regards as true. We may spell out the result of enrichment as follows (where \parallel_s is to be thought of as (part of) a recursive characterization of the notion of enriched meaning):

- (20) \parallel many of your students complained $\parallel_s =$
 a. $\text{many}_D(\text{of your students})(\text{complained}) \wedge$
 $\forall p p \in \parallel \text{ many of your students complained } \parallel^{\text{ALT}} \wedge p \rightarrow$
 $\text{many}_D(\text{of your students})(\text{complained}) \subseteq p$
 b. $\text{many}_D(\text{of your students})(\text{complained}) \wedge \neg \text{all}_D(\text{of your students})(\text{complained})$

It is easy to see that (20a) is equivalent to (20b). The latter format makes the scalar reinforcement more transparent. The former (namely (20a)) makes it evident that scalar enrichment tantamounts to adding a silent “only” to the basic meaning (cf. Rooth xx, Fox xx). In other words, it is as if scalar items bring to salience a question of the form “roughly how many...?” and the sentence winds up being taken as an exhaustive answer to such question.

Putting all this together, and adopting the abbreviation in (21a), we can define enrichment as in (21b).

- (21) a. $O_C[q] = q \wedge \forall p [[p \in C] \wedge p \rightarrow q \subseteq p]$
 (q and its entailment are the only members of C that holds)⁹
 b. $\parallel \phi \parallel_s = O_C [\parallel \phi \parallel]$, where $C = \parallel \phi \parallel^{\text{ALT}}$

This enrich operation applies freely at, say, scope sites. The parallel with focus semantics becomes at this point hard to miss. The only difference is that scalar alternatives are lexically driven and not necessarily activated by any special accentual pattern.

Actually, there is a further difference with focus which makes things more interesting (as it requires thinking of enrichment recursively). Under embedding, implicatures are sometimes preserved and sometimes “recalibrated”. Let us see this through an example. Consider a sentence like (22a). In principle, it can be enriched in two ways, represented by (22b-c) and (22d-e) respectively:

- (22) a. John believes that many of your students complained
 b. John believes that many of your students complained and it is conceivable for all John believes that non all did
 c. $O_C [\text{believe} (j, \text{many}_D(\text{of your students})(\text{complained}))] =$
 $\text{believe} (j, \text{many}_D(\text{of your students})(\text{complained}))$
 $\wedge \neg \text{believe} (j, \text{all}_D(\text{of your students})(\text{complained}))$
 d. John believes that many, though not all, of your students complained
 e. $\text{believe} (j, O_C [\text{many}_D(\text{of your students})(\text{complained})]) =$
 $\text{believe} (j, \text{many}_D(\text{of your students})(\text{complained}))$
 $\wedge \neg \text{all}_D(\text{of your students})(\text{complained}))$

If you work things out, you’ll see that (22b) (which corresponds to the interpretation (22c), i.e. a

⁹ I am going to assume that, for any p, $O_C(p)$ is only defined if a suitable set of alternatives (in the case at hand, scalar ones) is available.

root level application of enrichment) is actually rather weak; (22d-e) (which corresponds to (22e))

is considerably stronger (it entails (22b)). I think that (22d), i.e. the one with the embedded implicature, is the preferred reading. At any rate, such a reading is certainly there and to obtain it we must countenance that *believe* applies to the enriched interpretation of its complement. I.e. we must countenance an application rule of the following form:

(23) $\llbracket \text{believe that } S \rrbracket_s = \llbracket \text{believe} \rrbracket_s(\llbracket \text{that } S \rrbracket_s)$

You see here the recursion taking shape. However, things change considerably if we consider a sentence like (24a). Here the embedded implicature would correspond to (24b-c); the matrix one to (23d-e) (I am representing *doubt* as \neg *believe*).

- (24) a. John doubts that many of your students complained
 b. John doubts that many but not all of your students complained
 c. \neg believe (j , O_{ALT} many_D(of your students)(complained)
 d. John doesn't believe that many of your students complained but believes that some did.
 e. $O_C \neg$ believe (j , many_D(of your students)(complained) =
 \neg believe (j , many_D(of your students)(complained)
 \wedge believe (j , some_D(of your students)(complained)

Sentence (24a) hardly ever has an interpretation like (24b); such interpretation is only available in

special contexts (and with the help of appropriate stress on *many*); more normally, if (24a) implicates anything, it implicates something like (24d). Here, the original (embedded) implicature disappears. And a new one surfaces.¹⁰

In comparing (22) with (24), readers will immediately realize that the factor responsible for this pattern must be the monotonicity properties of *doubt*, which is a downward entailing (DE) function (more or less assimilable to “not believing”). Roughly speaking, (canonical) implicatures (like those from *many* to *many but not all*) may well be preserved under embedding within non DE (i.e. non “negation like”) functions; while typically they are recalibrated when embedded in DE functors (a generalization we shall refine shortly). This means that the semantics we use to compute the strong meaning in cases like (24) is:

(25) $\llbracket \text{doubt that } S \rrbracket_s = O_C \llbracket \text{doubt} \rrbracket(\llbracket \text{that } S \rrbracket)$

So, putting (23) and (25) together, we get something like:

$\llbracket \alpha \rrbracket_s (\llbracket \beta \rrbracket_s)$, if α is not DE

(26) $\llbracket \alpha \beta \rrbracket_s =$
 $O_C \llbracket \alpha \rrbracket(\llbracket \beta \rrbracket)$, otherwise¹¹

¹⁰ The observation that negation affects implicature computation was already made in Gazdar (1979). Horn (xx) generalized Gazdar's observation to all DE contexts. For relevant discussion, cf. also Levinson (2000).

¹¹ Actually, since $O_C \llbracket \alpha \rrbracket(\llbracket \beta \rrbracket)$, is only defined if β contains a scalar term. So the following definition is more precise (or more pedantic, as the case may be):

$\llbracket \alpha \rrbracket_s (\llbracket \beta \rrbracket_s)$, if β is not DE

$\llbracket [\alpha \beta] \rrbracket_s = \llbracket \alpha \rrbracket_s (\llbracket \beta \rrbracket)$, if $\llbracket \beta \rrbracket$ is DE and β contains no scalar term

While this implementation is open to the allegation of being ad hoc, and one can surely try to

improve on it, behind it there is a rather neat generalization:

- (27) In enriching a meaning, accord preference to the strongest option
(if there is nothing in the context/common ground that prevents it)

This principle predicts the preference for the embedded enrichment in (22) and for the root one in (24), which seems *prima facie* in line with intuitions and, if true, vividly exposes the “spontaneous logicity” of language. In adding SIs, speakers seek to optimize information content (= logical strength) in a way that keeps track of the effect of entailment reversing contexts (like the DE ones).

Notice that this reasoning can apply iteratively (i.e. recursively). So, for example, we can embed a sentence like (24a) further. And if the embedding function is not DE, then we can well get an embedded implicature:

- (28) a. I am sure that John doubts that many of your students complained
b. I am sure that John disbelieves that many of your students complains but he believes that
some did.¹²

It is not hard to imagine a situation in which one would utter say (28a) with the intention of conveying something like (28b).

So, in a compositional characterization of the notion of enriched meaning, the switch from (22) to (23) can be obtained by a “clever” definition of functional application. If the function is not DE, we use simple functional application (which leads to embedded implicatures). But the strengthened meaning of the argument should be preserved as such only if its strengthening doesn’t lead to its contrary; which will inexorably happen if the function is DE. In the latter case, the implicature must be recalibrated, i.e. locally adjusted. This gives an idea of how the pragmatics of scalar implicatures may be set up recursively. To complete the picture, we need to say something about multiple scales and implicatures embedded in the wrong place, as it were. We do this in the following two subsections.¹³

3.2. Multiple scales.

Often enough, one finds more than one scalar item in the same sentence:

- (26) a. Someone smokes or drinks
b. Someone (though not everyone) smoke or drink (but not both)

The strong meaning of (26a) is something like (26b). How can we obtain it? And how do we keep track of multiple scales? The simplest way to go seems to me to have multiple

$$O_C \|\alpha\|_s (\|\beta\|), \text{ where } C \text{ is } \|\alpha\|(\|\beta\|)\text{'s scale in } \|\alpha\|(\|\beta\|^{ALT}), \text{ otherwise}$$

¹² For unclear reasons, the implicature in (28b) is stronger for examples like.

(a) I am sure that John doubts that all of your students complained

But this does not affect our main point

¹³ “Globalistic” alternatives to this view can be found in Sauerland xx and Spector xx. See Chierchia (2004) for arguments against globalism. I should, however, add that it is technically feasible to adopt the algorithms proposed by Sauerland or Spector and used them in a cyclic manner, along the lines suggested here.

cyclic application of enrichment at clausal nodes. So assuming a LF like (27a) for (26a), we want something like (27b) as its strong meaning.

- (27) a. Someone_i [t_i smoke or t_i drinks]
 b. O [some (one) λx_i O [smoke(x_i) \vee drink(x_i)]]

Now, if we consider both the scales of *some* and *or* as part of the same set of alternatives to (27a) we get the following picture:

- (28) Someone_i [t_i smoke or t_i drinks]

Someone_i [t_i smoke and t_i drinks]

everyone_i [t_i smoke or t_i drinks]

Everyone_i [t_i smoke and t_i drinks]

The spatial arrangement and arrows indicates the entailment relations. What happens then is that if we try to compute the implicature at the root level in sentences like (27a), we won't find a *unique* scale among the alternatives activated by the lexical entries. A natural stipulation to make in this connection is that in such a situation we wouldn't know which scale to pick; and hence we wouldn't know how to strengthen. On the other hand, if we apply strengthening cyclically, handling implicature triggers in the order in which they are introduced (as in (27b)), each time we deal with a unique scale, which simplifies things greatly. As this seems natural enough, I will adopt it:

- (29) a. To strengthen via O, the scale must be uniquely determined
 b. $\|\phi\|_s = O_C(\|\phi\|)$, where C is ϕ 's scale in $\|\phi\|^{ALT}$

If there is more than one scale for ϕ in ALT, the definite description " ϕ 's scale in $\|\phi\|^{ALT}$ " fails to be proper and consequently strengthening fails. This forces us to choose the strengthening represented in (27b), a welcome result. For this to work, we also need of course to assume that whenever we use O, the relevant alternatives are "used up". In other words, the alternatives to, say, [t_i smoke or t_i drinks] differ depending on whether it is interpreted "plainly" (i.e. in terms of its unenriched meaning) or "scalarly" (i.e. in terms of its enriched meaning). So we must set up our definition of alternatives as follows:

- (30) $\|[t_i \text{ smoke or } t_i \text{ drinks}]\|^{ALT} = \{ \text{smoke}(x_i) \vee \text{drink}(x_i), \text{smoke}(x_i) \wedge \text{drink}(x_i) \}$
 $\|[t_i \text{ smoke or } t_i \text{ drinks}]\|_s^{ALT} = \{ \lambda x_i \text{ O } [\text{smoke}(x_i) \vee \text{drink}(x_i)] \}$ ¹⁴

So, in the general case, alternatives are generated and grow freely. Each time we use them for enrichment, the set of alternatives shrinks. It is plausible to assume as a general felicity condition on utterances that if a set of alternatives is active (i.e. relevant) by the end, it must be used (i.e. alternatives, when active must lead to some form of enrichment). This can be seen as a generalization of the principle of relevance.

- (31) If the speaker utters S and S is associated with a set of alternatives ALT, then use ALT to enrich S.

¹⁴ Technically, this tantamounts to saying that alternatives are specified not just relative to an expression, but relative to an expression and one of its interpretation. So, for each expression, what gets actually defined is $\langle \alpha, p \rangle^{ALT}$, where p is one of α 's interpretations (i.e. $p = \|\alpha\|$ or $p \in \|\alpha\|_s$). Cf. Appendix III.

If we stuck to what we just said, its net effect of would be that the only way to strengthen something like (26a) would be as in (26b); something like $O [\text{some (one)} \lambda x_i [\text{smoke}(x_i) \vee \text{drink}(x_i)]]$ comes out undefined. However, this seems too strong. For consider a discourse like:

- (31) I am positive that some of my students smoke or drink and I believe that, in fact, some of them may well do both.

In this discourse we seem to be intending the implicature associated with *some* (i.e. the outermost scalar item) while we are explicitly removing the implicature associated with *or* (i.e. the embedded one), something our system, as sketched so far, seems to disallow. It can happen, in other words, that something in the common ground or in the discourse makes it clear that the scalar alternatives are either irrelevant or otherwise excluded, as in example (31). Scalar alternatives are active by default, but can be deactivated by information present in the context. One way of implementing technically this idea is by assuming that each scalar term S has a two predictable lexical variants $S_{[+/-\sigma]}$ (related by a (trivial) lexical shift); the strong variant $S_{[+\sigma]}$ has active alternatives and lead to enrichment; the weak variant $S_{[-\sigma]}$ doesn't activate scalar alternatives. In a context that disfavors the activation of alternatives, we choose $S_{[-\sigma]}$ over $S_{[+\sigma]}$. Assume, further, that for $O_C[p]$ to be well formed, C must be appropriately filled (i.e. the assertion p must have alternatives different from itself). This way something like $O_C[p \text{ or}_{[+\sigma]} q]$ is felicitous, while $O_C[p \text{ or}_{[-\sigma]} q]$ is not. So, the intended reading of example (31) can be represented as $O [\text{some}_{[+\sigma]} (\text{one}) \lambda x_i [\text{smoke}(x_i) \vee_{[-\sigma]} \text{drink}(x_i)]]$. (We will omit marking the σ -subscript on a scalar term if the context makes it clear which is intended).

Summing up, a sentence like (26a) can be strengthened in the following ways:

- (32) $\| \text{someone}_i [t_i \text{ smoke or } t_i \text{ drinks}] \|_s =$
 $\{ O [\text{some}_{[+\sigma]} (\text{one}) \lambda x_i O [\text{smoke}(x_i) \vee_{[+\sigma]} \text{drink}(x_i)],$
 $O [\text{some}_{[+\sigma]} (\text{one}) \lambda x_i [\text{smoke}(x_i) \vee_{[-\sigma]} \text{drink}(x_i)],$
 $[\text{some}_{[-\sigma]} (\text{one}) \lambda x_i O [\text{smoke}(x_i) \vee_{[+\sigma]} \text{drink}(x_i)]] \}$

This in turn entails that if we think of $\| \cdot \|_s$ as a procedure that assigns to expressions their enriched meanings, we must not think of it as a function, but as a relation (or alternatively, we must think of it as defining a range of admissible enriched interpretations). The set in (32) constitutes the admissible strengthened interpretations of a sentence of the form *someone p or q*; which one we pick among those, depends on which of the (lexically activated) set of scalar alternatives actually fits the context (where in absence of information to the contrary, we presume that the strongest does). Generally, in what follows, I'll focus the discussion on the strongest options.

It might be worth underscoring that use of lexical features like $[+/-\sigma]$ does not turn the present approach to a ri-edition of an ambiguity approach to scalar implicatures. This is so not only because scalar entries are predictable variants of each other, but especially because our theory predicts a specific distribution of strengthened readings in DE vs non DE contexts. In particular, as we know from the discussion in section 3.1., the present theory predicts patterns of the following sort:

- (29) a. John doubts that many_[+\sigma] of your students complained

- b. * \neg believe (j , O_C many_[+σ] (of your students))(complained)
- c. O_C \neg believe (j , many_[+σ] (of your students))(complained)
- d. John believes that many_[+σ] of your students complained
- e. believe (j , O_C many_[+σ] (of your students))(complained)
- f. * O_C believe (j , many_[+σ] (of your students))(complained)

It is very unclear how an approach that simply says that scalar lexical entries are ambiguous could make similar predictions.

The full power of the present system can be appreciated even more if we consider multiple occurrences of scalar items within DE contexts. Here is a moderately complicated example:

- (34) a. No one who smokes and_[+σ] drinks lives up to 80_[+σ]
- b. There are people who smoke or drink (but not both) and live up to 80
- c. There are people who smoke and drink and live to an age close to 80.

Assuming that the scalar terms *and* and *80* have active alternatives, sentence (34a) can well be

used to implicate (34b) and (34c). So its strong meaning should be (34a) plus (29b) and (29c).

This is indeed what our definition of application predicts; and it is perhaps worth underscoring

that the intended result cannot be obtained through a *single* application of the O-operator. We have to use it twice as follows:

- (35) a. $O[O[\text{no}(\lambda x_i \text{one}(x_i) \wedge \text{smoke}(x_i) \wedge \text{drink}(x_i))](\text{lives up to } 80)]$
- b. $O[\text{no}(\lambda x_i \text{one}(x_i) \wedge \text{smoke}(x_i) \wedge \text{drink}(x_i))]$

The square brackets in (35a) indicate the scope of O. Consider in particular the most embedded occurrence of O, isolated in (35b). As the type of *no one smokes and drinks* is $\langle\langle e,t \rangle, t \rangle$, we have to generalize O to such type (cf. Rooth (19xx)). So, in working (35b) out, the alternatives we would be considering are of the form:

- (35) $\{\lambda P. \text{no one who smokes and drinks } P, \lambda P. \text{no one who smokes or drinks } P\}$,
P a variable over properties.

As usual, O says that the only alternative that is going to hold is the one (that is going to be) uttered. So we get:

- (36) $O[\text{no}(\lambda x \text{one}(x) \wedge \text{smoke}(x) \wedge \text{drink}(x))] =$
 $= \lambda P[\text{no}(\lambda x \text{one}(x) \wedge \text{smoke}(x) \wedge \text{drink}(x))(P) \wedge \neg \text{no}(\lambda x \text{one}(x) \wedge (\text{smoke}(x) \vee \text{drink}(x)))(P)]$
 $= \lambda P[\text{no}(\lambda x \text{one}(x) \wedge \text{smoke}(x) \wedge \text{drink}(x))(P) \wedge \text{some}(\lambda x \text{one}(x) \wedge (\text{smoke}(x) \vee \text{drink}(x)))(P)]$

When the argument corresponding to the VP comes in, the second occurrence of O takes its usual course and, at the end of the day, we get the intended strengthened reading for (34a). The fact that the strengthening of expressions headed by a DE function requires this stepwise, argument by argument, subclausal application of O, suggests that it is indeed right making it part of the definition of application itself (as per definition xx, above). Contrary to what happens for non DE contexts, the application of strengthening to DE

contexts cannot be readily accomplished via a clausal application of O (or whatever subsumes its effects).¹⁵

We thus see that a consideration of multiple scalar implicatures yields interestingly complex patterns that can be handled in reasonably systematic ways, in spite of their complexity.

The basic generalizations we propose are (i) that enrichment takes place cyclically bottom up and

that (ii) when we apply a function *f* to an argument *A*, if *f* is not DE, we enrich the argument

f(O[*A*]); if *f* is DE enrich the result O[*f*(*A*)] (“recalibration”). In either case, addition of SIs leads

to strengthening.

While this seems to be generally correct, there are also cases of enrichment that don’t lead to strengthening. Such cases too must somehow fit into the picture.

3.3. “Frozen” implicatures.

Consider an example like

(38) If many students complained, we are in trouble

Within sentence (38), the sentence *many students complained* appears embedded in the antecedent of a conditional, a downward entailing context. And in fact the (most salient) enriched interpretation of (38) is not something like (39a) but, if anything, something like (39b):

(39)a. If it many but not all students complained, we are in trouble

b. If many students complained, we are in trouble,

while if few students complained we are (probably) O.K.

If we express these options through the O-operator, here is what we get:

(40) a. if O[many students complained], we are in trouble

b. O [if many students complained, we are in trouble]

The scopes in (40a-b) correspond to the interpretations (39a-b), respectively. The preference for the interpretation represented by (40b) is in line with the preference for the strongest interpretation (i.e. the option we have already encountered and discussed). However, there are cases in which a reading isomorphic to (40a) seems to emerge as the preferred one. Consider for example the following discourse

(41) If many students complained, then we are better off than if all did

For sentence (41) to make sense, the antecedent has to be interpreted as follows:

(34) If many though not all students complained, then we are better off than if all did.

This type of cases (discussed in Levinson 2000) seem to involve an interpretation isomorphic to (40a). Now, as the reader can readily verify, interpretations of this sort are in fact weaker than the plain assertion. In general it is easy to show that:

(41) $[p \rightarrow q] \subseteq [O[p] \rightarrow q]$ (where ‘ \subseteq ’ stands for “entails”)

¹⁵ An even more complicated case (discussed in Chierchia 2004) is:

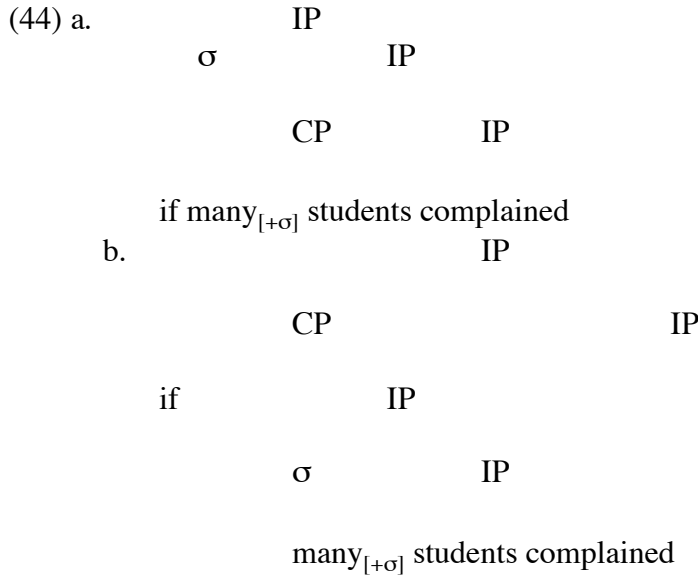
(a) Few people that smoke and drink live up to 80

This has also the implicature “some do...”. Scalar enrichments of this complexity are not discussed in proposals alternative to the present one like, e.g., such as Sauerland (xx) or Fox (xx).

So (49a) is an example of an *enriched* meaning that is not a *strengthened* meaning. Our system is designed to obtain strengthened meanings. And, as it stands, does not afford us interpretations like (4a). In Chierchia (2004), I suggested that they are to be obtained through something like domain selection. Here I wish to explore a different possibility, directly inspired by Fox (xx). We can imagine introducing at LF something like a “strongest meaning” operator. So far, O has been used only in the semantic metalanguage; we might to introduce an analogue of O at LF. Such an operator, call it ‘ σ ’, quite literally “freezes” or “locks in” the implicatures. σ [S] has as its (plain) meaning the (strongest) *enriched* meaning of S compatible with the context. Once σ applies to a constituent, the implicature of that constituent becomes part of its meaning and hence can no longer be removed or recalibrated.. Formally:

$$(41) \quad \|\sigma S\| = \iota \|S\|_s^{16}$$

It is, in fact, tempting in this connection, to adopt one of the familiar syntactic modes of implementing this. For example, we might say that strong scalar items have an (uninterpretable) syntactic feature [+ σ] that needs to be checked by an (interpretable) abstract operator σ (and viceversa: σ has to have a [+ σ] element in its scope). In the case under discussion, vis. (41), such an operator can be attached at different sites, namely:



Even though σ is a sort of syntactic projection of O, it doesn’t quite coincide with it. For example, it can be shown that if p and q both contain scalar terms, then the following equivalence holds:

$$(43) \quad \begin{aligned} \text{a. } \|\sigma [p_{[+\sigma]} \rightarrow q_{[+\sigma]}\| &= O[p \rightarrow O q] \\ \text{b. Example: } \sigma [\text{if John drinks and}_{[+\sigma]} \text{ drives, he gets two}_{[+\sigma]} \text{ months probation}] &= \\ O [\text{if John drinks and drives} \rightarrow O \text{ he gets two months probation}] &= \end{aligned}$$

¹⁶ Actually, since $\|S\|_s$ may include the plain meaning, what we want is:

$$\|\sigma S\| = \iota p [p \in \|S\|_s \wedge \forall q \in \|S\|_s p \subseteq q]$$

If John drinks and drives he gets two months (and no more) of probation while if he does only one of the two, he does not get two (or more) months probation

This is so because a single occurrence of σ can check simultaneously several occurrences of $[+\sigma]$ (by analogy with *wh*-dependencies). Interpretively, this can correspond to several applications of the relevant enrichment operation (namely *O*). In general, a root application of σ to a sentence *S* is going to lock in the strongest interpretation of *S*.

The present approach also rules out representations of the following sort, as cases of feature mismatches (where the second is a violation of minimality/intervention, however you want to cash in on it):

(44) a. * σ [John smokes $or_{[-\sigma]}$ drinks]

a'. smoke(j) \vee drink(j)

b. * σ [John is either smoking $or_{[-\sigma]}$ grading some $_{[+\sigma]}$ assignments]

b'. O [smoke (j) $\vee_{[-\sigma]}$ some $_{[+\sigma]}$ (assignments) λx grading(j,x)]

These are welcome results. Notice that (44a) would be interpreted as (44a'); this is *per se* innocent; however, the σ operator would play no semantic role, something that is clearly uneconomic. In (44b), the situation is different (and worst). An LF like (44b) would be interpreted as (44b'), where the alternatives associated with *some* are active, but those associated with *or* are not.. The reader should be able to compute that (44b') entails that John is not smoking, something we clearly don't want as a possible meaning sentences like (44b) (cf. Chierchia 2004, Fox xx for further discussion). It should also be emphasized that these result are obtained using completely standard assumptions on feature checking (or its equivalent).

The introduction of a strong assertion operator constitutes a departure from Chierchia (2004). The link between that proposal and the present one is in the definition in (42): σ is defined in terms of the recursively characterized notion of enriched interpretation, $\parallel \parallel_s$ (which remains essentially the same as before). There are close antecedents in the literature to this use of assertoric operators. One is Rooth's xx focus operator, that marks at LF the site at which focal alternatives are factored into the meaning. Also Krifka (19xx) proposes a couple of similar operators in order to deal with *any*; part of our goal is to provide further arguments that Krifka's operators are indeed motivated by the behavior of SIs. Finally, Fox (xx) proposes to deal with SIs in terms of an abstract only-operator. In our terms, Fox's proposal can be viewed as the reverse of the present one. Rather than defining recursively enriched meanings (i.e. $\parallel \parallel_s$) and then specify the semantics of a strong-meaning operator in terms of $\parallel \parallel_s$, Fox introduces directly such an operator in the syntax; then a definition of enriched meaning can be specified as, roughly, an LF containing occurrences of σ in appropriate places. Putting aside questions of detail, there are two main reasons that lead me to prefer the present option. The first is that, as we saw, an "abstract only" won't quite do in DE contexts: the semantics of such an operator would have to be duly articulated to get such contexts right (and it remains to be seen whether once this is done we wind up with a proposal essentially different from the present one). Second, as we shall see shortly, pragmatic enrichment doesn't always take the form of exhaustivization. Other options, associated with the activation of different sets of alternatives, must be countenanced. The indirect path we follow will enable us to do so in an arguably principled way, as we shall see shortly.

This is all quite sketchy (something only partially remedied in the appendix), but perhaps sufficient to our purposes. What we have tried to do in this section is setting up a sufficiently explicit formal machine (which can be provided with some independent motivation) in order to formulate a (partly new) theory of polarity phenomena building on the Domain Widening idea. To the formulation of such a theory we now turn.

4. Negative Polarity.

In this section we will address the issue of “pure” NPIs, namely items like *mai/ever* that disallow FC uses (also minimizers like *lift a finger* would fall into this category). However, for convenience, we will illustrate our proposal mostly with *any*, focusing on its NP facet. The reader should bear in mind that a more adequate characterization of items of the *any* type will have to wait until section 5.

4.1. “Large” Domain-alternatives.

Recursive pragmatics enables us to systematize (and, in a sense, integrate) the proposals by Kadmon and Landman, Krifka, and Lahiri on NPIs. To see how, I will start out with a proposal close to Krifka’s. Then I will modify it in ways that will bring out its connections to the others. Recall the basic idea: (NP) *any* in English has the same meaning as an indefinite like *some*, plus DW. I will work towards my proposed implementation of this insight through an example.

Let us assume that every predicate carries a world variable, which is filled according to general principles (cf. Groenendijk and Stokhof 1982; for a recent proposal, see Percus (2000)). Furthermore, let us assume that quantification (and abstraction) can be restricted to contextually salient domains. Here is a simple example:

(29) a. I saw a/some boy

b. $\lambda w \exists x \in D_w [\text{boy}_w(x) \wedge \text{saw}_w(I, x)]$

Formula (29b) is the proposition expressed by (29a).¹⁷ I use set variables D , D' , etc. to mark the (salient) quantificational domain associated with DPs: if someone utters (29a) one does so with a specific domain in mind (say, what is around us), for otherwise such a sentence could hardly ever be informative. The interpretation of D may vary from speaker to speaker; in spite of this, we understand each other because evidently our choices of D ’s overlap to a significant degree. D typically includes individuals that we are sure to exist, along with individuals we may be less sure about. Take, for example, our neighbor Fred. For all we know, he might or might not have sons. So, depending on specific aspects of the conversational dynamics, D might include Fred’s possible sons or not. Given a set D , D_w are those members of D that actually exists in w . Fred’s sons will be in D_w only if it turns out that in fact they exist in w . Adding (29b) to a common ground (the set of worlds that for all the illocutionary agents mutually believe, might be actual)¹⁸ excludes from such common

¹⁷ Here and throughout I ignore the (important) differences between *a* and *some*.

¹⁸ The standard reference on the notion of “Common Ground” is Stalnaker (1978). The proposal in the text, which uses world bound domains, can, perhaps, be viewed as a way of getting “Domain vagueness”, which Dayal (1998) argues is characteristic of PSIs. Notice, in fact, the resemblance with supervaluations (where each alternative corresponds to a partial interpretation). For further discussion, cf. sec. 5 below.

ground the worlds w' in which no member of D existing in w' is a boy I saw. Nothing new or particularly controversial so far (within a possible worlds semantics).

Now, the core meaning of a sentence involving *any* is just like (29) plus domain widening. I believe that DW takes place along two dimensions. First, we pick the largest of possible quantificational domain among the reasonable candidates. This means that all entities that for all we know might exist are factored in. Second, our uncertainty about quantificational domains may have some qualitative aspects. Take Fred again; and consider now his nephew John; we are sure that John exists; but we may be uncertain as to whether he is a man or still a boy; this means that in some worlds compatible with what we know he is a boy, in others he isn't; using *any boy* we might signal that our claim extends to him.

How do we express this formally?. Let us consider sheer domain size first. The only way to measure domain size is by comparison; this entails that the meaning of *any* must be inherently relational. It must involve comparison among D -alternatives. It is useful to visualize this with a toy example.

- (30) a. A system of “large” domains
 $D = \{a, b, c\}$ widest domain
 $D1 = \{a, b\}$
 $D2 = \{b, c\}$
 $D3 = \{a, c\}$

Suppose $D1$ - $D3$ are candidate domains for what's around here; then *any* would be associated with their union $D = D1 \cup D2 \cup D3$. In doing so, we still have anchoring to a specific D ; with the understanding that it is the largest one (among the alternatives at stake).

Consider next the inclusion of “marginal” boys. This must amount to a kind of modalization: we include into consideration all those individuals that in some world compatible with what we know are boys. Putting all this together, a sentence like (31a) (if it was grammatical) would have (31b) as its meaning; This has to be considered against the alternatives in (31c):

- (31) a. I saw any boy
b. Meaning: $\exists x \in D_w \exists w' [\text{boy}_{w'}(x) \wedge \text{saw}_w(I, x)]$ ¹⁹
c. Alternatives: $\exists x \in D_{i,w} \exists w' [\text{boy}_{w'}(x) \wedge \text{saw}_w(I, x)]$
where $1 \leq i \leq 3$

Active alternatives must be used to enrich plain meaning (by our extended principle of relevance). But what kind of enrichment is appropriate to *any* on the basis of the type of alternatives that by hypothesis it associates with? Given that D -alternatives do not form a scale, use of O (i.e. exhaustivization) seems inappropriate. Still, in choosing among alternatives, speakers do tend to go for the strongest one they have evidence for. If this happens also in the case of (31), we might be saying that even the most liberal (i.e. broad) choice of D makes the sentence true: the base meaning will acquire, in other words, an

¹⁹ From now on, and when no confusion arise, I will omit ' λw ' from formulae. So for example the formula in (31b) is to be understood as a short form for:

a . $\lambda w [\exists x \in D_w \exists w' \text{ boy}_{w'}(x) \wedge \text{saw}_w(I, x)]$

“even” like flavor (as both Krifka xx and Lahiri xx propose).²⁰ Let us spell this implicature out:

(32) Implicature:

$$\exists x \in D_w \exists w' [\text{boy}_{w'}(x) \wedge \text{saw}_w(I, x)] <_c \exists x \in D_{i, w} \exists w' [\text{boy}_{w'}(x) \wedge \text{saw}_w(I, x)]$$

where $1 \leq i \leq 3$ and $p <_c q = p$ is stronger/less likely than q relatively to the common ground c .

However, given the way the domains are chosen, (32) is logically false. This is so, because any of the alternatives in (31c) is logically stronger than the statement (31b); and hence the latter statement *cannot* be less likely than the former. It follows that sentence (31a) enriched by implicature (32) is inconsistent. Whence its deviance.

Contrast this with what would happen in a negative (DE) context.

(34) a. I didn't see any_D boy

b. statement: $\neg \exists x \in D_w \exists w' [\text{boy}_{w'}(x) \wedge \text{see}_w(I, x)]$

c. implicature: $\neg \exists x \in D_w \exists w' [\text{boy}_{w'}(x) \wedge \text{see}_w(I, x)] <_c$
 $\neg \exists x \in D_{i, w} \exists w' [\text{boy}_{w'}(x) \wedge \text{see}_w(I, x)]$

The statement (34b) plus the implicature are consistent. This constitutes a green light to adding it to our common ground. Such an addition is going to inform us that no matter what subset of D might turn out to be the actual domain, I saw nothing in that domain that could possibly be a boy. Domain widening yields its effects.

The appeal of this general line should be fairly clear. The *even*-like implicature arises from general Gricean principles (once one sees what the alternatives under consideration are). And it is also immediately clear that such an implicature just cannot be met in positive contexts, which explains the distribution of NPIs. But with this, also a potential problem comes readily to mind: implicatures that clash with the assertion do not generally yield ungrammaticality; they are simply removed (exploiting clashes of this sort is, in fact, *the* way implicatures are typically cancelled). So how come is something like (31) (an NPI licensing violation) ungrammatical? There is an impasse here between the way in which domain widening explains the distribution of NPIs (through Gricean principles) and how such principles are typically taken to work. The different lines explored by Kadmon and Landman, Krifka, and Lahiri can be viewed, in fact, as different ways of reacting to such an impasse.

²⁰ Actually, our proposal corresponds to what Krifka proposes for what he calls “emphatic” *any*. For non emphatic *any*, he proposes a purely scalar approach. According to it, asserting a sentence like (a) leads to the simultaneous negation of all weaker alternatives (as in scalar reasoning). The result, in positive contexts, is however contradictory, for it is impossible for an existential statement to be true in D without also being true in some of its subdomains. In negative contexts, per contra, one obtains a sensible meaning. Such an approach makes wrong predictions for sentences like

(a) * There must be any student in that building

The presence of a modal makes Krifka's proposed implicature coherent (something we must leave to the reader to verify). Consequently, (a) is predicted to be grammatical, contrary to fact. Krifka's proposal for emphatic *any* does not run into such a problem.

Evidently while scalar alternatives may be disactivated by the context, D alternatives cannot. Within “recursive” pragmatics, we have a possibly principled way of addressing this issue. Our approach to SIs has lead us to posit two variants of scalar terms: a strong $[+\sigma]$ variant, with active alternatives that need to be used for enrichment; and a weak $[-\sigma]$ variant with no active alternatives, for which no σ is necessary (or possible). In this set up it is indeed natural to expect that there be items associated with alternatives that *cannot* be disactivated: $[+\sigma]$ items with no weak alternant. The effect of this is that such items (in the case at hand, NPIs) will *have* to occur within the scope of σ ; their implicature has to be frozen in place, through an abstract operator σ . From a functionalistic stand point, this makes sense. If the role of domain widening is to induce an implicature, using an NPI in a context where such an implicature could not arise is self defeating. So, we can assume that NPIs carry an (uninterpretable) feature (specifically, a piece of possibly abstract negative morphology) that needs to be checked by an appropriate (interpretable) operator (namely σ). NPIs must be checked by σ (i.e., if you prefer, enter an agreement relation with something σ can attach to). The fact that NPIs need σ provides, in a way, further independent evidence for it.

Let us spell this out. We can assume that besides O, another available mode of enrichment is E (for ‘even’), defined as follows:

$$(33) \quad E_C(p) = p \wedge \forall q \in C [p <_C q], \text{ where } C = \text{ALT}$$

The choice between O and E is dictated by the nature of the alternatives: if (and, ideally, only if) C contains a scale, O is felicitous; if (and, ideally, only if) C contains partially ordered propositions, like D-variants, E is felicitous.²¹ In (34a) I specify an “official” lexical entry for *any* (but cf. appendix xx) and the alternatives it activates; in (34b), I spell out the specific form of pragmatic strengthening associated with DW.

(34) a. Lexical entry for *any*:

- i. $\|any_D\| = \lambda P \lambda Q \lambda w [\exists x \in D_w \exists w' (P_{w'}(x)) \wedge Q_w(x)]$
- ii. $ALT(\|any_D\|) = \{ \lambda P \lambda Q \lambda w [\exists x \in D'_w \exists w' (P_{w'}(x) \wedge Q_w(x))]: D' \subseteq D \wedge D' \text{ is large} \}$
- iii. *any* has an uninterpretable feature $[+\sigma]$

b. $\|\phi\|_s \supseteq E_C(\|\phi\|)$, where $C = \|\phi\|^{ALT}$

As with O, use of E shrinks the set of alternatives. Now, let us go back to the ungrammatical example (31a). In virtue of (34iii), it must occur in the scope of ‘ σ ’. So here is what we get:

- (35) a. * I saw any boy
 b. $\sigma [I \text{ saw any boy}]$
 |_____|
 c. $E_C(\exists x \in D_w \exists w' [boy_{w'}(x) \wedge see_w(I, x)])$
 d. $\exists x \in D_w \exists w' [boy_{w'}(x) \wedge see_w(I, x) <_C \exists x \in D_{I,w} \exists w' [boy_{w'}(x) \wedge see_w(I, x)]]$

²¹ Notice that if C contains scalar alternatives, $E_C(p)$ yields a non contradictory statement only if p is the strongest member of the scale. Perhaps we might require that a form of enrichment is felicitous only if it yields meaningful results for all the alternatives at stake. That way we wouldn’t have to say anything to prevent E from applying to scalar terms.

Any carries a feature that needs to be checked by σ . As σ can be adjoined to clausal nodes, we do so in (35b) and the syntactic requirement on *any* is duly met. However, σ locks in the implicature. Thus the interpretation of (35b) is (35c). And this is a unusable contradiction (as the implicature it carries, viz. (35b) is necessarily false). No way out. Contrast this with what happens in a negative context (like (33) above, repeated here):

- (36) a. I didn't see any boy
 b. $\sigma \neg$ [I see any boy]
 |_____|
 c. $E_C(\neg \exists x \in D_w \exists w' [\text{boy}_w(x) \wedge \text{see}_w(I, x)])$
 d. $\neg \exists x \in D_w \exists w' [\text{boy}_w(x) \wedge \text{see}_w(I, x)] <_C \neg \exists x \in D_{i,w} \exists w' [\text{boy}_w(x) \wedge \text{see}_w(I, x)]$

In a sentence like (36a), we have an additional site at which the feature associated with *any* can be checked, namely after negation. The semantics we get this time is perfectly sensible. And domain widening comes happily to fruition (in the sense that using it has lead to something stronger than the available alternatives). This generalizes to all DE contexts. We now see exactly how the computational system forces NPIs to occur in DE contexts.

Perhaps, a couple observations are appropriate. First, σ can be thought of as what makes negation (and other DE heads) “strong” or “affective” (giving precise semantic content to this notion). And second, one might expect the special morphology that induces checking or agreement with the implicature freezing operator σ to be sometimes “visible”. Cases of “negative concord” can be viewed in this light:

- (39) a. non ho visto nessuno studente parlare a nessun professore
 (I) not saw no student speak with no professor
 b. $\sigma \neg$ [I saw any student speak with any professor]

It is tempting (following, in a renewed set up, the insights of Laka 1990 and Ladusaw 1992) to explain negative concord along the following lines. N-words in languages like Italian have roughly the same semantics as (NPI) *any*. They are, therefore, domain widening existentials. This forces checking by σ , which can only yield something interpretable in conjunction with negation and other negation like operators. That is why negation must be present and can affect more than one N-word (without resulting in multiple negations). Moreover, since in the case of N-words, the NPI actually carries a piece of *overt* negative morphology, the locality conditions on checking and the range of heads that can sustain σ and do the job may be more strictly defined than those associated with *any*. This, in fact, seems to be supported also by language internal evidence: *nessuno*, lit. ‘no one’ has a narrower distribution than *any* (e.g. it is not licensed in the restriction of *every*); *mai* ‘ever’, where overt negative morphology is opaque, has, instead, a distribution very similar to that of *any*. There is obviously a lot of work to be done in this connection. But the division of labor between syntax and semantics looks promising.

A general criticism that has been leveled against the DW idea is that widening doesn't seem to always have to take place. This is particularly evident with N-words. A sentence like (39a) can be used having a specific salient domain in mind, just like its English translation, and doesn't *necessarily* require expanding such domain to include marginal cases. As it turns out, this is, in fact, consistent with the use of DW adopted here. The lexical entry for an NPI (cf. 34a) contains an implicit reference to a specific domain, just like any other quantifier. So *nessuno* (or *any*) will be relativized to a specific,

pragmatically set domain. However, alternatives are activated, and they automatically generate the relevant implicature. And such implicature cannot be cancelled. This mechanism sometimes will reflect real uncertainty on the quantificational domain. But this doesn't have to always happen: sometimes we merely have a formal requirement that limits indefinites subject to it to DE contexts. Power of grammaticization, if you wish. DW, as implemented here, is *potential* for domain widening.

Summing up, we see how what is common to the proposals that exploit DW for NPIs re-emerges in the present approach. The lexical entry for *any* activates domain alternatives, which generate an implicature according to completely general principles. We know that sometimes implicatures can be frozen in place. The implicature associated with NPIs has to (via agreement or checking with the operator responsible for freezing). This only works in DE contexts. We have done little more than implement the DW idea in “recursive pragmatics”.

4.2. Intervention.

As is known since at least Linebarger (xx), NPIs are subject to “intervention” effects. I've argued in Chierchia (2004) that NPI intervention is due to implicatures. While I will not be able to present here in full the arguments in favor of such a view, I will none the less give a sketch of how the account (in a slightly modified form) goes. This is useful, as it will give us a glimpse of how multiple alternatives can be handled (which will come in handy later on).

Here is a typical minimal pair that illustrates the relevant phenomenon:

- (41) a. It's never the case that a new doctor has any experience
b. ?? It's never the case that every new doctor has any experience.

In both (41a) and (41b), *any* is separated from its licenser never by a scalar term (*a* and *every*, respectively). Intervention of *every* yields a degraded grammaticality judgment, while intervention of *a* does not. Why?

Let us begin with (41b). Its initial representation must be something like (42a); hence its LF must be either (42b) or (42c):

- (42) a. not [every_[+σ] new doctor has any_[+σ] experience]
b. not σ [every_[+σ] new doctor has any_[+σ] experience]
c. σ not [every_[+σ] new doctor has any_[+σ] experience]

Any must be in the scope of (checked by) σ. And there are two options for meeting this requirement are represented in (43b-c). However, option (43b) is clearly doomed to failure: adding the implicature triggered by D-widening to [every new doctor has any experience] (i.e. in a in positive contexts) results in contradiction. So (43c) is really our only chance. But now let us see what happens. Recall that alternatives cumulate till they are used by some enrichment operation. So here is how the alternatives associated with (42a) are going to look like:

- (44) not [every doctor has any_D experience],..., not [some doctor has any_D experience]
not [every doctor has any_{D1} experience],..., not [some doctor has any_{D1} experience]
not [every doctor has any_{D2} experience],..., not [some doctor has any_{D2} experience]
....

Lines represent scales (including the scale associated with the assertion); the column represent D-alternatives (where for each *i*, $D_i \subseteq D$). Now according to our approach to implicature projection, when a DE function (*not* in the case of (43)) applies to its argument, implicatures are automatically recalibrated. This results in the following:

- (43) $\ll \text{not [every doctor has any}_D \text{ experience]} \gg_s =$
 [Cf. (26) sec. 3.1]
 $= O(\text{not [every doctor has any}_D \text{ experience]}) =$
 $\text{not [every doctor has any}_D \text{ experience]} \wedge [\text{some doctor has any}_D \text{ experience}]$

Given this, the alternatives to (44) become:

- (44) $O(\text{not [every doctor has any}_{D1} \text{ experience]})$
 $O(\text{not [every doctor has any}_{D2} \text{ experience]})$

...

At this point, the implicatures associated with the D-alternatives will have to be factored in. The result will be:

- (45) a. $E(O(\text{not [every doctor has any}_D \text{ experience]})) =$
 b. $= O(\text{not [every doctor has any}_D \text{ experience]}) <_C O(\text{not [every doctor has any}_{Di} \text{ experience]})$
 (for any i)
 c. = i. $\text{not [every doctor has any}_D \text{ experience]} \wedge [\text{some doctor has any}_D \text{ experience}]$
 $<_C$
 ii. $\text{not [every doctor has any}_{Di} \text{ experience]} \wedge [\text{some doctor has any}_{Di} \text{ experience}]$

However, (45b) fails. This can be seen most easily from (45c); for it to obtain, the assertion (namely (45.c.i)) ought to be logically stronger than any of the alternatives (namely 45.c.ii). But it is easy to check that this is not so: while the first conjunct in (45.c.i) indeed entails the first conjunct in (46.c.ii), for the second conjunct it is exactly the opposite. Moral: the only available strong meaning (i.e. the one in which all the alternatives have been used) is contradictory:

- (46) $\ll \sigma \text{ not [every new doctor has any experience]} \gg = \emptyset$

Whence it deviance.

Contrast this with what happens in the case of (41a), repeated here, which is instead grammatical:

- (47) a. It's never the case that a new doctor has any experience
 b. $\sigma \text{ not [a}_{[+\sigma]} \text{ new doctor has any}_{[+\sigma]} \text{ experience]}$

Let us assume that the set of alternatives is the same as that of *every* (i.e. (44)).²² The crucial difference is in the first step, viz.:

- (48) $\ll \text{not [a doctor has any}_D \text{ experience]} \gg_s =$ [Cf. (26), sec. 3.1]
 $= O(\text{not [a doctor has any}_D \text{ experience]}) =$
 $\text{not [a doctor has any}_D \text{ experience]}$

The point is that under negation *a* becomes the strongest member of its scale; and whenever some *p* is the strongest member of a scale *C*, we get of course that $O_C(p) = p$. So no scalar implicature arises. And the alternatives to (49) will be:

- (49) $\text{not [a doctor has any}_{D1} \text{ experience]}$
 $\text{not [a doctor has any}_{D2} \text{ experience]}$

....

At this point, the even-implicature, triggered by the presence of D-alternatives will follow its usual course. And we get:

- (50) $\ll \sigma \text{ not [a new doctor has any experience]} \gg = E(\text{not [a doctor has any}_D \text{ experience]}) =$

²² Nothing changes in the argument if we assume that *a*, being a reduced form of the numerals, competes with the latter.

$$= \text{not } [a \text{ doctor has any}_D \text{ experience}] \wedge \\ \text{not } [a \text{ doctor has any}_D \text{ experience}] <_C \text{ not } [a \text{ doctor has any}_{D_i} \text{ experience}]$$

Domain widening yields in this case the right results.

Summarizing, if Chierchia (2004) is right, the basic generalization about NPI intervention is that (i) it is triggered by strong members of a scale and (ii) the culprit is the implicature that such items give rise to in DE contexts; this generalization follows for free, given independent assumptions about SI projection and the semantics of NPIs. Notice, furthermore, that the following representation would not be grammatical:

$$(51) \quad \text{not } \sigma [\text{every}_{[-\sigma]} \text{ new doctor has any}_{[+\sigma]} \text{ experience}]$$

This is a straightforward featural mismatch (the “syntactic” side of intervention). The effect of this is that in combination with NPIs with must use the strong version of scalar items.²³

Just one more case to complete the picture. Consider:

- (52) a. Few students understood anything
 b. Some students understood something

Sentence (52a) is grammatical (i.e. *any* is properly licensed); and it triggers the implicature in (52b). From the point of view of our generalization, this might be surprising, for we are claiming that scalar implicatures in some sense prevent D-widening from triggering their even-implicature. Yet in (52b) there clearly is/can be a scalar implicature. How is that possible? To see how things go, consider first the plain meaning associated with (52a) and its alternatives:

- (53) a. $\text{few}(\text{students})(\text{understood anything}_D)$
 b. $\text{few}(\text{students})(\text{understood anything}_D)$, $\text{no}(\text{students})(\text{understood anything}_D)$
 $\text{few}(\text{students})(\text{understood anything}_{D1})$, $\text{no}(\text{students})(\text{understood anything}_{D1})$
 $\text{few}(\text{students})(\text{understood anything}_{D2})$, $\text{no}(\text{students})(\text{understood anything}_{D2})$

...

Few is a DE function; DE functions involve recalibration, i.e. automatic insertion of O as in (44); however, O can apply only if in presence of a scale; and the arguments of *few* in (54a), namely *students* and *understood anything*, do not contain scales (the scale is associated with *few* itself). Hence O cannot apply in such a case as an automatic part of function application (cf. fn 11, sec. 3.1.xx). So we wind up with (53a-b). Now we have to discharge the alternatives. Given that the alternative contain both scales and D-variants, we have to use both O and E. But enrichment (at scope sites) is free. It can apply in any order. So we have two possible outcomes, namely

- (53) a. $O(E(\text{few}(\text{students})(\text{understood anything}_D)))$
 b. $E(O(\text{few}(\text{students})(\text{understood anything}_D)))$

In (53b) we first add the scalar implicature, then the D-implicature. This won't work (essentially for the same reasons why (46) doesn't work: the scalar implicatures gets added in first and makes the even-implicature contradictory). In (53a) we first add in the even-implicature (and discharge D-alternatives); then we compute the scalar implicature. By this route, we get the right results.

To put it differently, there are two candidate strong meanings, namely:

- (54) $\|\sigma \text{ few}_{[+\sigma]} \text{ students understood anything}_{[+\sigma]}\| \supseteq$
 a. $O(E(\text{few}(\text{students})(\text{understood anything}_D))) =$
 $\text{few}(\text{students})(\text{understood anything}_D) \wedge$

²³ This is something that had to be stipulated (as a lexical presupposition) in Chierchia (2004)

$$\begin{aligned} & \text{few}(\text{students})(\text{understood anything}_{D_i})] <_C \text{few}(\text{students})(\text{understood} \\ & \text{anything}_{D_i}) \wedge \\ & \text{some}(\text{students})(\text{understood anything}_{D_i})] \\ & \text{b. } E(O(\text{few}(\text{students})(\text{understood anything}_{D_i}))) = \emptyset \end{aligned}$$

Of these the only usable one is clearly (54a).²⁴

The facts are intricate. My sketch of the account leaves many details out. However, with the help of the appendix, readers might be able to reconstruct the relevant derivations and conclude on their own to what extent things work out the way I claim. Certainly, there is room for improvement when it comes to fine details of the algorithm for implicature projection. What is important is (a) the principled nature of interaction of scalar and domain implicatures and (b) the fact that the pattern of intervention for which NPIs are well known falls into place once such interaction is taken into account. This provides strong evidence in favour of the view that certain form of implicatures are systematically exploited by the computational system of grammar.

5. The birth of universal readings.

In this section, we will address the issue of FC of the *any* type (that allow NP uses) as well as that of FC of the *qualunque* type (that disallow NP uses) and discuss where their properties and quantificational force comes from. Then we will come back to the relation between these elements and pure NPIs.

5.1. Antiexhaustiveness.

One of the classic puzzles surrounding FC uses of elements like *any* is how come they so naturally seem to switch to a universal or quasi universal force, as the following standard examples illustrate:

- (40) a. Any cat meows
b. Yesterday, any student that was around dropped by

Now, indefinites, as is well known, are subject to “Quantificational Variability” effects:

- (41) A cat with blue eyes is always/usually/never intelligent

The quantificational force of an indefinite like *a cat* in (41) seems to be directly dependent on that of the quantificational adverb. This insight, which has given rise to Discourse Representation Theory and its derivatives (e.g. Dynamic Semantics), makes it extremely tempting to try to view the universal force of FC *any* as arising through a quantificational adverb of some sort. Such line of analysis has been proposed and developed in several variants (cf. e.g. Kadmon and Landman 1993, or Giannakidou 2001). However, there are problems with it. For one thing, there are clear cases of universal construals of FC *any* which don’t involve genericity: in sentences like (40b), generic operators just ain’t around. The universal force of the FC item would have to come from something else and it is not clear what that would be. (Saying it comes from the modifier, seems ad hoc, for intersective modification doesn’t usually work that way). Moreover, as shown by Dayal (1988), FC *any* does not display quantificational variability effects in ways comparable to those of indefinites like *a cat*. The following is an illustration:

²⁴ I.e. we should understand the semantics of the σ -operator as follows:

$\| \sigma S \| = \iota p [p \in \| S \|_s \wedge p \neq \emptyset \wedge \forall q \in \| S \|_s p \subseteq q]$.

- (42) a. A lion is usually majestic [from Dayal (1988)]
 b. * Any lion is usually majestic
 c. A philosopher is sometimes wrong
 d. Any philosopher is sometimes wrong

In (42a-b) we have an individual level predicate, which is incompatible with a frequency interpretation of the quantificational adverb. Sentence (42a) is grammatical, because the indefinite in subject position can act as a variable bound by the adverb. This construal is impossible in (42b), as witnessed by its ungrammaticality. In (42c-d) we have a stage level predicate. Sentence (42c) is ambiguous between a frequency construal of the quantificational adverb (“A philosopher is such that there are occasions on which she is wrong”) and a “variable” reading (“There are philosophers who are wrong”); sentence (42d), on the other hand only has the first reading. This pattern is hard to explain, if *any*-indefinites are variable like (or, more neutrally, if the source of their quantificational force is the same as for *a*-indefinites).

On the basis of considerations of this sort, Dayal concludes that the universal force of FC uses of *any* has to be endogenous to *any* itself. Whence her proposal to view FC elements of this sort as modalized universal elements. She argues that this accounts for many of their properties (including, e.g., subtriggering). However, this move seems to increase the conceptual distance between NP *any* and FC *any*. In one case we have an indefinite subject to DW. In the other a modalized universal element. Dayal is well aware of this problem and proposes that the unifying trait behind NPIs and FCIs has to be sought elsewhere, in what she calls “Domain Vagueness”. The intuition is that in felicitous uses of NPIs and FCIs what has to happen is that one doesn’t know what the quantificational domain at stake is really like. While the intuition behind domain vagueness might be sound, problems of implementation remain. It isn’t clear, for example, how exactly to build domain vagueness into the lexical entry for *any* (Dayal does it sort of “globally”). But, more to the point, domain vagueness and domain widening are *so* close; why doesn’t just one of them suffice? Why do we need, in the end, *two* independent assumptions on the semantics of FC *any*: (i) that it is a modalized universal and (ii) that it is domain vague? As we will now see, a reconsideration of DW, and more specifically, a slightly different, but equally natural implicature derivable from it might provide us with a more integrated view.

Kratzer and Shymoyama, in their analysis of German Free Choice *irgendein* have argued that DW can also trigger an implicature different from strengthening, one of extreme uncertainty. In the present section, I am going to extend (a variant of) their proposal to universal FCIs (namely, Italian [*qualsiasi N*] and FC *any*). I will postpone discussion of existential FCIs of the *irgendein* type until next section.

Imagine that the alternatives you consider are not domains of approximately equal size, but rather all of the possible choices (on a given totality). Imagine, in other words that the structure of the alternative domains is roughly the following:

- (43) $D = \{a, b, c\}$
 $D1 = \{a, b\} \quad D2 = \{b, c\} \quad D3 = \{a, c\}$
 $D4 = \{a\} \quad D5 = \{b\} \quad D6 = \{c\}$

Imagine now that against this finely structured range of alternatives you were to pick one, say $D3 = \{a, c\}$ (by saying, for example, that someone in $D3$ is the culprit). What would that convey to your hearer? Clearly, that you are excluding other options; and, in particular, that

you are excluding D5 (i.e. the complement of D3). The same holds for any other choice. So, conversely, what would, against the same background, the choice of D, i.e. the *maximal* option, convey? Plausibly, it would convey the opposite, namely that you do not exclude any option whatsoever.

This lays out the intuition. Now let us reconstruct it formally.

- (44) a. (Yesterday) I saw any student (that wanted to see me)
- b. Assertion: $\exists x \in D_w \exists w' [\text{student}_{w'}(x) \wedge \text{see}_w(I, x)]$
 Abbreviated as: $\text{some}_D (\text{student}) (\lambda x \text{ I saw } x)$
- c. Potential alternatives: $\text{some}_{D_i} (\text{student}) (\lambda x \text{ I saw } x)$, for any $D_i \subset D$
- d. Strengthened alternative assertions: $O(\text{some}_{D_i} (\text{student}) (\lambda x \text{ I saw } x))$
 $= \text{some}_{D_i} (\text{student}) (\lambda x \text{ I saw } x) \wedge \neg \text{some}_{D-D_i} (\text{student}) (\lambda x \text{ I saw } x)$
- e. Grice: $\neg \text{Know} (\text{speaker}, O(\text{some}_{D_i} (\text{student}) (\lambda x \text{ I saw } x)))$
- f. Epistemic step: $\neg O(\text{some}_{D_i} (\text{student}) (\lambda x \text{ I saw } x))$
- g. $\neg [\text{some}_{D_i} (\text{student}) (\lambda x \text{ I saw } x) \wedge \neg \text{some}_{D-D_i} (\text{student}) (\lambda x \text{ I saw } x)]$

The assertion is (44a) interpreted as (44b); it chooses explicitly the widest domain D. As we saw, such an assertion would compete with alternatives of the form in (44b), for every alternative domain D_i in (43). Each such alternative, if chosen, would be strengthened (by exclusivization) to (44d). Therefore, by standard Gricean reasoning, choosing (b) the speaker signals she has no evidence that the (strengthened) alternative holds (44e). Then, the epistemic step follows its usual course, taking us to (44f); which is equivalent to (44g).

Now a surprise comes. The implicature (44g) is equivalent to (45a). This, together with the assertion (44b), entails (45b):

- (45) a. $[\text{some}_{D_i} (\text{student}) (\lambda x \text{ I saw } x) \rightarrow \text{some}_{D-D_i} (\text{student}) (\lambda x \text{ I saw } x)]$
 (for any D_i , containing possible students)
- b. $\forall D [\text{some}_D (\text{student}) (\lambda x \text{ I saw } x)]$
 where D contains possible students

A sentence like *I saw any student (that wanted to see me)* must, therefore, be true for any domain that stands a chance (containing a possible student that wants to see me). And a quasi universal reading, thereby, comes about. The assertion by itself doesn't do it; and the implicature by itself doesn't either. The universal force comes about by putting, as it were, two and two together (the assertion and the implicature). In doing so, we are using nothing more than plausible Gricean principles and DW, on the assumption that the D-alternatives form a "complete" lattice structure of the form in (43).

So what does the difference between pure NPIs (like *ever* or Italian N-words) and *any* amounts to? We are playing here with two kinds of implicatures. The NPI implicature is an even-implicature (as suggested by Krifka and Lahiri); the FC implicature is antiexhaustiveness (as suggested by Kratzer).²⁵ Clearly, it is not simply the context that determines which implicature is relevant. For example, Italian *mai* (or a minimizer like *lift*

²⁵ Kratzer actually discusses the FC implicature only in the context of what we call existential FC. She doesn't exploit it to derive universal readings.

a finger) doesn't tolerate FC uses; used in a positive context *mai* doesn't trigger universal readings, it is simply ungrammatical. So it won't do to say that by using DW in positive context, a FC implicature will naturally arise. The differences must stem from differences in the set of alternatives. "Large" alternatives naturally go with an even-like implicature; complete lattice structures go with antiexhaustiveness. It is not implausible that different lexical items may be associated with different sets of alternatives. So, here is a possible candidate for the lexical entry associated with FC any:

$$(47) \quad ALT(any_D) = \{ \lambda P \lambda Q \exists x \in D' \exists w' [P_{w'}(x) \wedge Q_w(I, x)]: D' \subseteq D \\ \wedge D' \cap \lambda x \exists w' [P_{w'}(x)] \neq \emptyset \}$$

We have simply replaced the condition that the domains be "large" with the one that alternative domains must stand a chance (namely contain things that might possibly satisfy the restriction). So now even a D containing a single possible student (in the case of (44a)) will be in the alternative set. And the strengthening operation that naturally goes with alternatives of this sort is antiexhaustiveness, viz:

(48) Antiexhaustiveness

$$\|\phi\|_s \supseteq O^-_C \|\phi\| \text{ where } C = \|\phi\|_s^{ALT} \text{ and}$$

$$O^-_C(p) = p \wedge \forall q \in C [q \rightarrow q^-] \text{ (where } q^- \text{ is } q\text{'s complement; i.e. if } D' \text{ is } q\text{'s domain variable, then the domain variable of } q^- \text{ is } D-D')$$

It is plausible to maintain that O^- can apply felicitously only when the alternative set of domains is

closed under complementation.

Summing up so far, pure NPIs (like Italian N-words) are going to be associated with large D-alternatives. This is going to trigger an even-like alternative, E. And E confines pure NPIs to DE contexts. FCIs like are going to be associated with alternatives of any size (including small ones), which are going to trigger O^- . Everything else stays the same. Both NPIs and FCIs must be checked by the implicature freezing operator. Here is a sample derivation involving FC *any*:

- (49) a. I saw any_[+σ] student (that wanted to see me)
 b. σ [I saw any_[+σ] student]
 c. some_D (student) λx I saw x \wedge
 $\forall D_i [\text{some}_{D_i} (\text{student}) (\lambda x \text{ I saw } x) \rightarrow \text{some}_{D-D_i} (\text{student}) (\lambda x \text{ I saw } x)]$
 d. $\forall a \in \text{possible student} \cap D$ [I saw a]

(I keep ignoring, for simplicity, the modifier *that wanted to see me*). Formula (49d) constitutes a semi formal rendering of the assertion and the implicature together, which I am going to use from now for convenience.

It is interesting to consider, next, what happens to a FC element like *any* under negation. In principle, a sentence like (50a) might admit of two scope options. The first is illustrated in (50b)

- (50) a. I didn't see any student (that wanted to see me)
 b. $\neg \sigma$ [I saw any student]
 c. $\neg \forall a \in \text{possible student} \cap D$ [I saw a]

Here negation has scope over the implicature freezing operator. Accordingly, we first lock the implicature in, then we negate. It's interpretation is (roughly) as in (50c). This corresponds to the “rethorical” reading of (50a): the “I didn't see just any student” type.²⁶ But there is also another possibility, illustrated in (51). We can first negate, then “check” the implicature.

- (51) a $\sigma \neg [I \text{ saw any}_{[+\sigma]} \text{ student}]$
 b. statement: $\neg \text{some}_D (\text{student}) (\lambda x I \text{ saw } x)$
 c. implicature: $\forall D_i [\neg \text{some}_{D_i} (\text{student}) (\lambda x I \text{ saw } x) \rightarrow \neg \text{some}_{D-D_i} (\text{student}) (\lambda x I \text{ saw } x)]$

Now notice that (51b) entails (51c). To see this, drop the universal quantifier from (51c) instantiating it to an arbitrary D_i in the alternative sets:

- (52) $\neg \text{some}_{D_i} (\text{student}) (\lambda x I \text{ saw } x) \rightarrow \neg \text{some}_{D-D_i} (\text{student}) (\lambda x I \text{ saw } x)]$

If D is (as per our hypothesis) the largest domain, it is clearly impossible that (51b) is true and (52) false, for (51b) entails both the antecedent and the consequent of (52). Conclusion: the implicature is automatically satisfied in any situation where the statement is true. Just like with “pure” NPIs, in negative contexts, we are left solely with DW; the FC implicature vanishes.

The conclusion is simple and, arguably, compelling: a lexical item with specifics in (47) is predicted to have a quasi universal force in positive contexts and to act as NPI in negative context. Its (similarity to and) difference from pure NPIs is very explicitly laid out: it is a difference in the type of alternatives activated. This explains why some languages might choose different lexical entries to signal association with different alternative sets; while others might opt to have one item covering both domains. It also explains why an item may start as a pure NPI and then turn into a FCI (by expanding its alternative sets) and viceversa. Finally, we also see that it is incorrect to think of *any* as “ambiguous” between an NPI and FC interpretation: English *any* has a unitary meaning viz. (47), which simultaneously accounts for its NPI uses (in DE contexts) and its FC uses in non DE contexts.

5.2. Subtrigging.

In Dayal (1998) several of the key generalizations about FCIs like *any* were carefully laid out. Her conclusions, as we saw, were that English *any* is “inherently” modalized, universally quantified, and domain vague. That insight seems to be basically correct. In fact, it fits with a view of polarity perhaps more general than one could hope for. The “inherent” part of her proposal needs to be qualified. The quantificational force of FC *any* is not written into its lexical entry. It stems from an implicature, triggered by the domain alternatives activated by it. Dayal also proposes an account of subtrigging which, in so far as I can make out, is the only one that stands a chance at being right among those currently available. The present subsection is devoted to showing how her account extends to our proposal.

Consider sentence (53a) and its semantics, according to the present proposal (53b).

²⁶ It needs to be explained why the rethorical reading generally requires a special intonational contour. It would be desirable to derive this effect from the interaction of a principled proposal on FCIs (such as the present, arguably, is) and the theory of Focus. In the context of the present paper, I don't have anything to say about this.

- (53) a. I saw any student
 b. $\forall D \exists x \in D_w \exists w' [\text{student}_w(x) \wedge \text{see}_w(I, x)]$
 where D contains at least a possible student

What does (53b) actually say? In essence, that any possible student is such that I saw her. This is an extremely strong statement; perhaps, too strong to ever be true. I can only see actually existing students; I cannot see something that does not exist. Because of our liberal take, D is surely going to include some such non existing entities. But this makes (53b) way too strong to ever be true. There is a kind of presupposition failure here between the modalized character of the restriction and the episodic/actualistic character of the scope. It is as if we have gone too far with our domain widening to the point of obtaining a restriction unsuitable to be used in episodic statements.

Consider now an occurrence of *any* “subtriggered” by a relative clause, like (54a). What would the structure of the restrictor be? Something like (54b) looks plausible:

- (55) a. I saw any student that wanted to see me
 b. $\forall D \exists x \in D_w \exists w' [\text{student}_w(x) \wedge \text{want}_w(x, \lambda w'' \text{see}_{w''}(x, \text{me})) \wedge \text{see}_w(I, x)]$
 c. $D \cap \lambda x \exists w' [\text{student}_w(x) \wedge \text{want}_w(x, \lambda w'' \text{see}_{w''}(x, \text{me}))] \neq \emptyset$
 d. $\lambda x [\text{student}_w(x) \wedge \text{want}_w(x, \lambda w'' \text{see}_{w''}(x, \text{me}))]$

In (55b), we have two world variables around. The one associated with the head noun *student* gets bound by *any* (as is generally the case). The relative clause, however, brings along a new variable (presumably, through the tense associated with the main verb *want* in the relative clause). Such a variable, eventually, gets associated with the actual world. The exact details of how this happens depend on specifics of the semantics of postnominal modifiers and tense sequencing. However, its outcome will, plausibly, be a restriction of the form given in (55c) (obtained through an intermediate stage which will look roughly as in (55d)). Such a restriction is going to contain possible students that wanted *in fact* to see me (and hence they must be actual students). This results in a perfectly natural statement, one that can be satisfied. Thus, subtriggering provides us with the anchoring we need to be able to use FC (and hence modalized) items in episodic contexts. The general fact that FC items can be used in episodic contexts only subject to specific restrictions typically provided by a relative clause (but sometimes perhaps also by information present in the context) seems to receive a reasonable account.

5.3. “Pure” FC items.

With this in place, we can now look at an interesting difference between Italian FC *qualsiasi* and English *any*, related to the puzzling behavior of *qualunque* under negation. As noted in section 2, an unmodified *qualunque* when negated seems to have only the rethorical “not just anyone” reading. For example:

- (55) a. (?) Non ho visto qualunque studente
 (I) not have seen whatever student ‘I didn’t see just any student’
 b. $\neg \sigma$ [I saw any student]
 c. $\neg \forall a \in \text{possible student} \cap D$ [I saw a]

Out of the blue, (55a) is awkward, unless intonation and/or context warrant a “not just anyone” interpretation. In our terms, this means that (55a) only admits of the LF in (55b), which results in the interpretation in (55c). The other option, which is available for *any* (cf. (51a), above), seems not to be available for *qualunque*. To put it differently, *qualunque* is a

“pure” FC element, that doesn’t “double up” as an NPI. In terms of the present proposal, we have to rule out, for *qualunque*, construals such as the one in (51a), where the freezing operator has scope over the DE operator. A not unreasonable way to obtain this effect is by insisting that the strengthened statement (i.e. the one with the implicature added in) lead to something that is indeed stronger than the plain one: the strengthened statement must, in other words, asymmetrically entail the plain one. Let us see how this does the trick in the case that interests us. Consider first a positive (non DE) context with *qualunque*:

- (56) a. vedrò qualunque studente
 (I) will see whatever student
 b. statement: $\text{some}_D (\text{student}) \lambda x \text{ I will see } x$
 c. strengthened statement:
 i. LF: $\sigma [\text{I will see any student}]$
 ii. Interpretation: $\text{some}_D (\text{student}) (\lambda x \text{ I will see } x) \wedge$
 $\forall D_i [\text{some}_{D_i} (\text{student}) (\lambda x \text{ I will see } x) \rightarrow$
 $\text{some}_{D-D_i} (\text{student}) (\lambda x \text{ I will see } x)]$
 $= \forall a \in \text{possible student} \cap D [\text{I will see } a]$

In this case, the strengthened statement asymmetrically entails the plain one. Consider, per contrast a negative context:

- (57) a. non vedrò qualunque studente
 (I) will see whatever student
 b. statement: $\neg \text{some}_D (\text{student}) \lambda x \text{ I will see } x$
 c. strengthened statement:
 i. LF: $\sigma \neg [\text{I will see any student}]$
 ii. Interpretation: $: \neg \text{some}_D (\text{student}) \lambda x \text{ I will see } x \wedge$
 $\forall D_i [\neg \text{some}_{D_i} (\text{student}) (\lambda x \text{ I will see } x) \rightarrow$
 $\neg \text{some}_{D-D_i} (\text{student}) (\lambda x \text{ I will see } x)]$
 $= \neg \text{some}_D (\text{student}) \lambda x \text{ I will see } x$

As shown above, in this case, the strengthened statement turns out to be identical to the plain one. This state of affairs seems not to be tolerated by *qualunque*. Technically, this can be obtained by imposing a presupposition on the version of the freezing operator selected by *qualunque*:

- (58) $\|\sigma\| = \|\sigma\|$, if $\|\sigma\|$ asymmetrically entails $\|\phi\|$; undefined otherwise

Boldface σ is just like σ with a presupposition tacked in: σ yields a felicitous statement only if the result of freezing the implicature returns something strictly stronger than the unenriched statement. We stipulate that “pure” FC elements like *qualunque* select for σ (as opposed to σ). As a consequence of this, the implicature associated with it can only be frozen successfully in positive contexts (the result can then, of course, be embedded further as in (54)).

Evidence for this analysis comes from the puzzling facts observed in (14)-(16), sec. 2, and repeated here.

- (59) a. Non leggerò qualunque libro $\neg \forall$ (rethorical)
 (I) won’t read whatever book

- b. Non leggerò qualunque libro che mi consiglierà Gianni $\forall \neg (/ \neg \exists); \neg \forall$
(rethorical)

(I) won't read any book that Gianni will recommend to me.

The factual generalization is that while the rethorical reading is the only option for unmodified FC *qualunque*, another option becomes available when such items are modified (options which makes such items start act like NPIs). Now, we just saw how the rethorical reading for (a sentence like) (59a) is obtained and why the NPI reading is absent. However, a further possibility is expected, since, in principle, it should be possible to scope the embedded DP out. The corresponding LF would be:

- (60) a. [qualunque libro]_i non leggerò t_i
b. σ [qualunque libro]_i non leggerò t_i
c. $\forall a \in \text{possible book} \cap D \neg$ [I will read a]

If we lock the implicature in after having scoped the object out, as in (60b), the presuppositions of the freezing operator are met (i.e. we obtain something which asymmetrically entails the unenriched interpretation of (60a)). However, the result constitutes a subtrigging violation. Consequently, it will be ruled out by whatever rules things like *I read any book* out. This immediately predicts that subtrigging is going to rescue sentences like (60a), on the intended reading. This is indeed what (59b) seems to show. The relevant analysis is given in (61):

- (61) a. [qualunque libro che mi consiglierà Gianni]_i non leggerò t_i
b. σ [qualunque libro libro che mi consiglierà Gianni]_i non leggerò t_i
c. $\forall a \in \text{possible book that Gianni will recommend to me} \cap D \neg$ [I will read a]

What we have here is a $\forall \neg$ reading, which being equivalent to a $\neg \exists$, gives the impression that *qualunque* all of a sudden takes up an NPI behavior. But, as matter of fact, this isn't so; and we now see why. So, an intricate pattern seems to fall into place in a rather principled fashion.

It is worth summarizing where we stand so far. The system of PSIs can be schematized as in the following chart:

- (62) The system of polarity sensitive items
 σ [D-MAX]: pure NPIs [alcuno, mai, ever]
 σ [D-MIN]: NPIs/FC [any]
 σ [D-MIN]: pure FC [qualsiasi]

What the elements in (62) have in common is that (i) they activate domain (D-) alternatives and (ii) select for the implicature freezing operator. The latter is a device that prevents the implicature (induced according to general Gricean principles) from being removed (when things go wrong). Where the items in (62) differ is (i) in the size of the domain alternatives (MIN/MAX) and (ii) the variant of implicature freezing operator selected. MAX-alternatives are “large” domains (expressing our agreement on core cases and doubts about marginal cases). Selection of MAX alternatives triggers an *even* implicature. Such an implicature can be sustained only in DE environments (in non DE environments it results in contradiction). MIN-alternatives include all possible domains, down to the smallest ones, thereby indicating a more radical uncertainty. This results in a different implicature, antiexhaustiveness. Such an implicature, added to the assertion, precipitates a universal reading. Finally, implicature freezing can come about in two ways: with/without the presumption that the result is *properly* stronger than its input. I.e. there are two variants of

σ : a strong (presuppositional) one and a weak (presupposition free) one. Lexical items freely select (through agreement) either variant. As readers can check by themselves, if an item triggers *even* implicature, the presupposition of σ 's can never be met; hence pure NPIs can only select for presuppositionless σ . If an item selects for MIN alternatives, thereby triggering antiexhaustiveness, there are, instead, two possibilities, depending on what type of freeze is selected. If one goes for the “weak” option, we get a “double dealer” behavior: NPI like in negative contexts, FC in positive contexts. If an item goes for the “strong” freeze, one gets a pure FC behavior.

So it seems that systematicity raises, perhaps, its noble head. But several problems remain outstanding. In particular, recall that under certain type of modalities (e.g. imperatives) the “universal” force of *any* seems to vanish: Push any button! Moreover, there is a whole class of FCIs for which a universal interpretation is out of the question (German *Irgendein*, Italian *uno qualunque*). What about them?

6. Existential readings strike back.

In the present section, I deal with existential FCIs. The main idea to be developed draws even more directly from Kratzer and Shimoyama (2002) than the one discussed in sec. 5. (But only after having presented it, I will be able to discuss how exactly the present proposal relates to theirs.)

6.1. Combined effects of FC and indefinite morphology.

Besides the different quantificational force, a further characteristic of existential FCIs, noted in the introduction, is that their marginality in episodic contexts cannot be rescued by subtriggering:

- (63) a. ??Ieri ne ho discusso con un qualunque filosofo (che fosse disposto ad ascoltarmi)
 Yesterday (I) of-it discussed with a philosopher whatever (that wanted to listen)
 b. Ieri ne ho discusso con qualunque filosofo che fosse disposto ad ascoltarmi
 Yesterday (I) of-it discussed with whatever philosopher (that wanted to listen)
 c. Avrei dovuto discuterne con un qualunque filosofo
 (I) should have discussed of-it with a philosopher whatever

Out of the blue, (63a) is marginal, and the relative clause, if anything, makes things worse, in contrast with what happens with universal FCIs (cf. (63b)). An overt modality can rescue existential FCIs (as in (63c)). In fact, a way to rescue a non overtly modalized existential FCI, like (63a), is embedding/(imagining it embedded) in a context broadly construable as modal. The generalization that emerges is that existential FCI are ungrammatical in absence of a modal of some sort, modal which sometimes can be covertly supplied (perhaps in the form of an assertoric modality – cf. on this also Kratzer and Shimoyama 2002).

This generalization could be directly built into the grammar of existential FCIs (as K&S, in fact, do). We could simply state that an existential FCI *must* occur in the scope of a modal. But it would be more interesting if this link to modalities was derivable from what we have found out so far about FC in general and some other property of existential FCIs.

An even superficial look at the form of existential FCIs reveals that they are composed out of the FC morphology (*irgend* in German, *qualunque/qualsiasi* in Italian) plus overt indefinite morphology (*ein* in German, any numeral in Italian). In the best of all possible worlds, the behavior of existential FC should follow from the grammar of FC elements (which we have, let us suppose, independently established) plus the standard

contribution of overt indefinite morphology. The latter, typically, contributes two things: (i) existentiality and, importantly, (ii) an “exactly” implicature:

- (63) A man walked in
 i. Interpretation: $\exists x[\text{man}(x) \wedge \text{walked in}(x)]$
 ii. (Scalar) Implicature: $\neg \text{two}_D(\text{man}) \lambda x [x \text{ walk in}]$

The existentially closed semantics in (63.i) is already part of the semantics of universal FC; so that cannot be what is specific to existential FCIs. Which leaves us with the Scalar Implicature (63ii). That must be, then, the culprit. Implausible as this may *prima facie* appear, it seems to follow that existential FC items must be characterized by three things: (i) existentiality, (ii) an antiexhaustiveness implicature over domains and (iii) a scalar (uniqueness) implicature. These three properties jointly should suffice to explaining the special relation of existential FCIs to modals and the other differences from universal FCIs. As we shall see, this is nearly on the mark.

To make things concrete, let us consider a hypothetical example. (I assume that the indefinite article has roughly the same semantics as the first numeral *one* and competes therefore with numerals and write $[\exists n x \dots]$ for “there are at least n x ’s...”).

- (64) a. ?? Ho sposato un qualsiasi dottore
 (I) married a doctor whatsoever.
 b. Basic assertion: $\exists 1x \in D_w \exists w'(\text{doctor}_{w'}(x) \wedge I \text{ marry}_w x)$
 c. Alternatives:
 $\{ \exists 1x \in D_w \exists w'(\text{doctor}_{w'}(x) \wedge I \text{ marry}_w x), \exists 2x \in D_w \exists w'(\text{doctor}_{w'}(x) \wedge I \text{ marry}_w x), \dots$
 $\exists 1x \in D_w^i \exists w'(\text{doctor}_{w'}(x) \wedge I \text{ marry}_w x), \exists 2x \in D_w^i \exists w'(\text{doctor}_{w'}(x) \wedge I \text{ marry}_w x),$
 $\dots \}$

The basic meaning of an existential FCI like (64a) is identical to that of its universal FC counterpart, namely (64b). The alternatives, however, are different: an existential FCI is also a scalar term, so its alternatives will contain both scalar (rows) and domain alternatives (columns), as shown in (64c). These alternatives must be used up through appropriate forms of enrichment (so that the requirement that FC morphology be checked by σ can be duly met). Accordingly, the scalar alternatives must use O , the D-alternatives must use O^- . The result is shown in (65).

- (65) a. $\|\sigma \text{ ho sposato un dottore qualsiasi}\| = O^-(O(\exists 1x \in D_w \exists w'(\text{doctor}_{w'}(x) \wedge I \text{ marry}_w x)))$
 b. $O^-(\exists 1x \in D_w \exists w'(\text{doctor}_{w'}(x) \wedge I \text{ marry}_w x) \wedge \neg \exists 2x \in D_w \exists w'(\text{doctor}_{w'}(x) \wedge I \text{ marry}_w x))$
 c. $O^-(\exists ! 1x \in D_w \exists w'(\text{doctor}_{w'}(x) \wedge I \text{ marry}_w x))$
 d. $\exists ! 1x \in D_w \exists w'(\text{doctor}_{w'}(x) \wedge I \text{ marry}_w x) \wedge$
 $\forall D' [\exists ! 1x \in D_w' \exists w'(\text{doctor}_{w'}(x) \wedge I \text{ marry}_w x) \rightarrow \exists ! 1x \in D-D' \exists w'(\text{doctor}_{w'}(x) \wedge I$
 $\text{marry}_w x)]$

In (65b-d) I show the relevant steps of the computation.²⁷ We first work out the innermost parenthesis in (65b) (in (65c), I abbreviate $[\exists 1x \dots \wedge \neg \exists 2x \dots]$ as $[\exists ! 1x \dots]$, i.e. ‘there is

²⁷ It should be noticed that reversing the scope of O and O^- leaves things unchanged. Cf. appendix VI, for a proof.

exactly one x'). Then, we work out the outermost operator in (65d). Now, if our alternative domains contain more than one doctor (which they surely will, for otherwise there would not be any D-alternative), then (65d) is inconsistent for it says that the sentence *I marry exactly one doctor* must be true of every doctor. This seems to provide us with an account of why existential FCIs in plain episodic contexts are marginal (and not rescuable by subtriggering): the two implicatures jointly result in a contradiction.

But now let contrast this with what happens in a modal context. Embed (65a) under an (overt) modal and compute its interpretation.

- (66) a. Posso sposare un qualsiasi dottore
 (I) can marry a doctor whatsoever.
 b. Basic meaning:

$$\exists w R(w_0, w) [\exists 1x \in D'_w \exists w' (\text{doctor}_{w'}(x) \wedge I \text{ marry}_w x)]$$

‘there is an accessible world w , in which I marry a doctor’

Towards the computation of the relevant implicatures, notice that (66a) contains two scalar terms (*a* and *can*), plus the FC morpheme. The computation of the scalar implicatures takes place according to the general principles laid out in sec. 3. For simplicity, I will ignore the outermost scalar item (i.e. the modal) and focus on the embedded one. Since enrichment applies freely at scope sites, we have the following options:²⁸

- (67) a. $\exists w R(w_0, w) [O^-(O(\exists 1x \in D_w \exists w' (\text{doctor}_{w'}(x) \wedge I \text{ marry}_w x)))]$
 b. $O^-(\exists w R(w_0, w) [O(\exists 1x \in D'_w \exists w' (\text{doctor}_{w'}(x) \wedge I \text{ marry}_w x))])$

So, it now becomes possible to apply antiexhaustiveness after the modal has been added. We know from (65) that (67a) is inconsistent. But let us see what happens with (67b). Here are the relevant computations:

- (68) a. $O^-(\exists w R(w_0, w) [O(\exists 1x \in D_w \exists w' (\text{doctor}_{w'}(x) \wedge I \text{ marry}_w x))])$
 b. $\exists w R(w_0, w) [\exists !1x \in D_w \exists w' (\text{doctor}_{w'}(x) \wedge I \text{ marry}_w x)] \wedge$
 $\forall D' [\exists w R(w_0, w) [\exists !1x \in D'_w \exists w' (\text{doctor}_{w'}(x) \wedge I \text{ marry}_w x)]]$

It is not hard to see that (68b) is consistent. First, the assertion says that there is some accessible world w , in which something in D is a doctor I marry (and there are no two such things). Second, antiexhaustiveness says, that for every subdomain D' of D containing a doctor, there is a world in which I marry him. We obtain, in other words, a distribution of doctors across worlds: any possible doctor constitutes an option for me to marry. Here is the picture:

Worlds	Doctors I marry
w1	d1
w2	d2

²⁸ Other a priori conceivable combinations are ruled out by various aspects of the algorithm presented in section 3. In particular,

(a) $O^-(O(\exists w R(w_0, w) [\exists 1x \in D_w \exists w' (\text{doctor}_{w'}(x) \wedge I \text{ marry}_w x))])$

is ruled out because the alternatives associated with *a* have to be handled before the alternatives associated with *can* come into play. This, plus the observation in fn 27, appendix VI leaves those in (70) as the only options.

.....
wn
.....

dn

I.e. the doctors must distribute over the worlds in such a way that in each world I marry a different one, so that all the possible doctors are the chosen one in some world or other. This is a neat result. The interaction of modalities and the FC implicature (antiexhaustiveness) yields without any stipulation whatsoever the right kind of meaning. For (66a) plus its implicatures says that I must marry one doctor, and any conceivable doctor is a possible option. This is, in essence, the insight of K&S. What we add to this is that we don't have to worry about stipulating that existential FC must occur in the scope of a modal. For if there is no modal around, a sentence with an existential FC is unusable.²⁹

6.2. Intervention: Reprise.

We reached the conclusion that in non modal contexts existential FC give rise to contradictory implicatures, rescuable by the insertion of a modal. However, potentially there is another way to rescue existential FCIs, namely by inserting a quantified DP between the implicature freezing operator and the FCI:

- (1) a. (??) un linguista ha sposato un qualunque dottore
a linguist married a doctor whatever
- b. σ [un linguista_i [un qualunque dottore_j [t_i ha sposato t_j]]]
- c. $\forall D'[\exists y \text{ linguist}_w(y) \wedge \exists! x \in D'_w \exists w'(\text{doctor}_{w'}(x) \wedge y \text{ marry}_w x)]$
- d. For every doctor a, some linguist marries a and only a

It is not hard to see that (1c) is not contradictory (as the informal paraphrase in (1d) illustrates). So, if nothing is added, we would be predicting that sentences like (1a) are grammatical, which isn't correct. Only modals can do the job.³⁰

The observation in (1) suggests that we have to stipulate that no other DP can intervene between σ and the DP σ associates with (i.e. the DP whose alternatives σ operates on). A modal in the same position is just fine:

- (2) a. puoi sposare un qualunque dottore
- b. σ [can [a doctor_j [pro_i marry t_j]]]
- c. $\forall D'[\exists w R(w_0, w)[\exists! x \in D'_w \exists w'(\text{doctor}_{w'}(x) \wedge \text{you marry}_w x)]]$

Even though this is a stipulation, it has a form familiar from much work on locality: it looks like, yet again, a minimality effect. The relation between σ and its associated DP is disturbed by the intervention of another, somehow dishomogeneous DP. Modals, we may be tempted to conclude, do not give rise to such an effect because they are “sufficiently different” from DPs, to use Rizzi's (xx) intuition.

It is worth to relate this idea to what we have said about NPI-intervention. Consider abstractly a typical intervention structure. It has the following form:

- (3) Op YP[- α]. XP[+ α]

We have some category XP with morphology α in a syntactic relation with an operator Op and some YP, carrying some feature incompatible with [+ α], on the path of the relation

²⁹ The same applies to universal modals. Cf. appendix V for a worked out example

³⁰ I owe this point to Jon Gajewsky.

creates an obstacle. Our variant on proposals of this sort for NPI intervention goes as follows.

- (4) a. ? I never saw every rich man help anybody
 b. I σ never saw every_[+σ] rich man help anybody_[+σ]
 c. * I σ never saw every_[-σ] rich man help anybody_[+σ]

The LF in (5b) is syntactically well formed. However, the feature [+σ] on scalar NPs has semantic consequences: it makes the scalar alternatives active. This, according to general principles of implicature projection gives rise to a contradiction. Whence the deviance of (5b). The variant of every with [-σ] does not have active alternatives and would not yield, therefore, any semantic problem. But a structure like (5c) is syntactically ill formed.

It is tempting to generalize this idea a bit. For one thing, what we are marking as [+σ] should be thought of as a piece of morphology (that gets mapped onto σ); and, second, the semantic consequences of such morphology might be more extensive. In particular, it seems plausible to conjecture that the relevant morphological features (say, NPI-morphology) induce their canonical effect (D-widening) on any suitable DPs they associate with. Let me elaborate on this a bit. Contrast (5) with (6).

- (5) a. I never saw a rich man help any body
 b. I σ never saw a_[+σ] rich man help anybody_[+σ]

Weak scalars do not generate interpretive problems in general. Moreover, indefinite DPs, like *a* in (6), are the kind of entities that can in principle carry negative polarity morphology. So, syntax requires that they do (think of [+σ] as whatever characterizes NPIs morphologically). But then such morphology has its usual semantic effects, namely, in example (6), it induces DW on *a rich man*. In other words, for all purposes (syntactic and semantic) such DP becomes an NPI (i.e. triggers domain extension). This seems intuitively right: indefinites in structures like (6) do feel NPI-like. For example, we feel strongly tempted, in cases of this sort, to insert *overt* negative polarity morphology (like the minimizer *single* in (6b)). Another way to put it is to say that we can interpret (6a) to the extent that we insert something like a null minimizer in the intervening DP.

Let us go back now to the FC case. Consider the modal in (2) again. Here, such modal removes the interpretive obstacle to the type of domain extension called for by the FC morphology. Hence, the sentence becomes semantically coherent and all is well. Contrast this with (1), repeated here:

- (6) a. un linguista ha sposato un qualunque dottore
 b. σ [un linguista_{[+σ]i} [un qualunque_[+σ] dottore_j [_i ha sposato _j]]]
 c. $\forall D' \forall D [\exists ! 1x \in D_w \exists w' \text{ linguist}_{w'}(y) \wedge \exists ! 1x \in D' \exists w' (\text{doctor}_{w'}(x) \wedge y \text{ marry}_w x)]$
 d. For every possible linguist *a* and every possible doctor *b*, *a* married *b* and it is not the case that any other possible linguist married any other possible doctor.

In the subject position of (7a) we now have an indefinite, which *can* carry FC morphology. Hence, in a structure like (7), it must for syntactic reasons. So we wind up with a structure of the sort shown in (7b), which (thinking now of [+σ] as FC morphology) tantamounts to the insertion of some sort of null *qualunque* (just like we did in (6)). But then the FC morphology follows its usual course (viz. induce antiexhaustiveness). And combined with indefinite morphology, this triggers an interpretive clash: (7c) is contradictory (on the

assumption that there is more than one possible doctor/linguist) as illustrated by its informal paraphrase (7d). So we do get here an irresolvable intervention effect.

Summing up, if the present approach is on the right track, we would have (i) a reason why in plain non modal contexts existential FC are marginal (an implicature clash) (ii) a reason why modals remove the interpretive obstacle (distribution over worlds) and (iii) a reason why DPs which could in principle also remove the interpretive obstacle fail to do so.³¹ Be that as it may, even if this turns out to be wrong or not to be the whole story, still I think that the facts in (1)-(2) point, at the very least at a descriptive level, in the direction of a minimality effect.

6.3. Further consequences and remarks.

The idea of a sort of “distribution across worlds” is present in different forms in previous work on FC elements. One finds it, for example, in Dayal 1998, Giannakidou 2001, Saeboe 2001, (with disagreements on the nature of the modality involved). The first attempt to “deduce” this effect from Gricean principles is Kratzer and Shimoyama (2002), of which the present work is a direct development. They, however, do not discuss the relation between existential and universal FCIs, nor do they derive the differences among them from the presence vs. absence of a scalar implicature. There are other differences as well between the present proposal and theirs. Kratzer and Shimoyama adopt an alternative semantics. Here we stay within the boundaries of a multidimensional semantics (more directly along the lines of Rooth’s approach to focus or Krifka’s proposal on NPIs, for example). Also, even though I would like to stay as neutral as I possibly can on details of implicature projection, the present proposal requires something like implicature freezing and, to the extent to which it is successful, provides evidence for it. The implicature freezing operator bears a family resemblance to Rooth’s (1992) $\sim\sim$ operator for focus; and it also resembles Fox’s recent “abstract only”. But it has somewhat different properties from either of them.

One consequence of the present approach is that when an existential FCI is not in the scope of an overt modal, if the resulting sentence is somehow acceptable, the presence of a covert modal operator has to be assumed. For otherwise, the implicatures associated with the indefinite would be inconsistent. So a sentence like (69a) must have a logical form like the one in (69b):

- (69) a. Gianni è uscito di corsa e non sapendo che fare, ha bussato ad una porta qualsiasi
Gianni ran out and not knowing what to do, knocked at a door whatsoever.

b. $\mathbb{A}_I \sigma$ [Gianni knocked at a door]

³¹ I believe that DW on non indefinite DPs is impossible for principled reasons. The example of every is quite clear. Widening the domain of every automatically makes the sentence stronger:

- (a) For any D, D’ such that DD' , everyD(P)(Q) every D’(P)(Q) (for any P and any Q)

This means that no implicature could possibly arise. And we would have nothing to get system of polarity sensitive items going. We may assume that D-widening morphology on non indefinite DPs (e.g. universals) is always deviant. So the intervention effect at hand (semantically motivated on indefinites) generalizes to all sort of DPs.

result. The interpretation is roughly “it is not the case that x must invite somebody and that anybody is an option”; a reasonable candidate to the rethorical interpretation. The second possibility is given in (71c); in this case the FC implicature is entailed by the assertion. It therefore disappears. We thus get an NPI like behaviour.

In contrast with this, Italian selects for σ . And this is going to be incompatible with the LF (71c), because it requires that the implicature lead to proper strengthening. Which can only happen if freezing applies to something positive (as in (71b)). Thus Italian only has the LF corresponding to (71a) and, under negation, only gets the rethorical reading.

We are now also in condition of understanding why even the most universal of the FC items, like English *any* or Italian *qualsiasi* embedded under certain modals all of sudden acquires an existential reading (which, in fact, sometimes emerges as the preferred one):

- (72) a. Taste any donut
b. Assaggia qualsiasi donut

The logical form of (72) will clearly contain the modal operator associated with the imperative, whatever that may be. This opens up the possibility of freezing the FC implicature either within the scope of the imperative or at the top level (with scope over the imperative). Schematically:

- (73) a. $\square \sigma$ you taste any donut
b. $\square \forall$ you taste any donut
c. $\sigma \square$ you taste any donut
d. $\square \exists$ you taste any donut $\wedge \forall \diamond$ you taste any donut

In (73a), we first freeze the implicature obtaining a universal reading. Then the imperative comes in. The result might be paraphrased as “You must taste every possible donut”, a possible (if disfavored) reading for (72a-b). In (73c), first the imperative comes in, then we freeze the implicature. The result is fully equivalent to what we usually get with existential FCIs (minus the uniqueness implicature). So the paraphrase is “it is necessary that you taste a donut and for any particular donut, it is possible for you to taste it”.

On the whole, the pattern of existential vs universal readings of FCIs is rather intricate. Yet, it seems it is beginning to yield.

7. Concluding remarks.

Our chart of PSIs can be integrated as follows:

- (74) The system of polarity sensitive items
- | | |
|---|-------------------------------|
| σ [MAX]: pure NPIs | [mai, ever] |
| σ [MIN]: NPIs/FC (universal) | [any] |
| σ [MIN]: pure FC (universal) | [qualsiasi] |
| σ [MIN, SCAL]: NPIs/FC (existential) | [irgendein] |
| σ [MIN, SCAL]: pure FC (existential) | [uno/due/tre/...NP qualsiasi] |

Let us go through (74) and thereby summarize our main points. What is common to PSIs of the type studied in this work is that they all involve domain widening. Widening is something you only see by comparison. So, the form widening must take is the activation of a series of alternatives, out of which the largest gets selected. I implement this in a bidimensional semantics in which next to the basic value, we compute a range of alternatives. What such alternatives do is trigger implicatures, according to general principles. The general point was made by Grice long ago: a conversational move is judged against a background of other a priori conceivable moves. Selecting a move over another

can be very telling. Riding on this, speaker-hearers can enrich communication in highly efficient ways, an opportunity which is exploited constantly and systematically. This, however, doesn't take place just when an utterance is completed, as one might think. It happens throughout the computation of meaning; implicatures can be factored in a recursive, compositional manner.

The elements in square brackets in (74) are just a mnemonic for the alternatives associated with the relevant entry. It is part and parcel of this general picture that implicatures are determined by the nature of the alternatives. A lot needs still to be done in this domain in order to arrive at general principles (which are not slightly disguised "just so" stories) on how implicatures come about. Here is, however, the picture we get at this point.

If the alternatives form a scale (i.e. a linearly ordered set), then choosing an element will naturally indicate that all alternatives which are not entailed are not deemed to hold. This resembles closely a null only operator O ; I have argued that DE contexts require special care in handling O (essentially, O has to be built into each step functional application involving DE functors).

If the alternatives do not form a perfect scale (e.g., they constitute a partially but not linearly ordered set), we seem to have at least two plausible options. Suppose that the alternatives are relatively "close" to each other. For example, we are considering possible domains of similar size. Then, we ought to choose the one which enables us to make the strongest (and hence least likely) statement; accordingly, the hearer, making the usual leap of faith, will conclude that that is indeed what is intended and an "even" implicature naturally comes about. We have formalized this via E .

If, on the other hand, we are excluding no alternative of any size, down to the smallest possibility, then it sounds like we are really uncertain; we ought to choose, therefore, the assertion that commits us the least, the one that enables us to rule out fewer possibilities. From this, the hearer will jump to the conclusion that the speaker is trying to rule in most possibilities (and hence the existential statement being made is likely to hold of *every* alternative). This is O^- .

The operators O , O^- and E are not syntactically projected; they are only part of the semantic computation. However, we must have at Logical Form an implicature freezing operator σ , syntactically real at least to the same extent as focus operators. Such operator (which assigns to a sentence the strongest implicature that can be factored in without contradiction) is necessary to obtain the various readings that scalars can give rise to. In particular, it is necessary to get strengthening in the "wrong" spots (i.e. within the scope of DE functors). Such an operator is also crucial for polarity sensitive items. It gives us a syntactically plausible way to state the requirement that implicatures triggered by PSIs cannot be removed.

In fact, there are two plausible ways of freezing the implicature in place. One is simply to add it in. In this case, depending on whether we are in a negative context or not, we will get proper strengthening or disappearance of the implicature. When it "disappears", the implicature becomes just a vehicle to make potential domain widening visible. The second way to freeze the implicature, is to insist on proper strengthening (i.e. the implicature can be frozen only if the result asymmetrically entails the unenriched assertion). This will force the freezing to take place only with respect to a sentence which is, as it were, non negative. Whence the "positive polarity" flavour of some FCIs (a

notion that otherwise has no formal status, in so far as the present range of constructions is concerned).

The system we get, if in many ways preliminary, conjugates formal explicitness with conceptual simplicity. Most of the similarities/differences among a fairly extended (and perhaps typologically significant) range of PSIs seem to fall into place.

APPENDIX. The Formal Theory.

I am going to sketch a formally explicit characterization of the notion of “(pragmatically) enriched meaning”, building on Chierchia (2002). Such a characterization doesn’t deal with all aspects of pragmatic enrichment. It takes the form of a recursive definition that to each well formed LF α , associates its enriched interpretations $\|\alpha\|_s$. The definition of $\|\alpha\|_s$ is done in terms of the standard definition of (unenriched) meaning $\|\alpha\|$, which I take here for granted and assume provides us with a mapping from LF into TY2 (viz. a typed language with variables over worlds – Gallin xx). Since enriched meanings are, in the general case, more than one, $\|\alpha\|_s$ defines a set; i.e. $\|\alpha\|_s$ is to be thought of as a relation, rather than as a function. The notion of enriched interpretation $\|\alpha\|_s$ exploits, in addition to $\|\alpha\|$, the set of alternatives for α . In the general case, the set of alternatives is defined for each expression α , relative to one of its interpretations p ; so we can imagine defining α ’s alternatives via a function $\langle \alpha, p \rangle^{\text{ALT}}$, where p is an appropriate description (using, say, a logical form) of α ’s meaning. However, since the context will generally make it clear which of α ’s interpretation is relevant, I’ll abbreviate $\langle \alpha, p \rangle^{\text{ALT}}$ as $\|\alpha\|_s^{\text{ALT}}$. $\|\alpha\|_s$ and $\|\alpha\|_s^{\text{ALT}}$ are defined by a simultaneous recursion.

I. Basics.

Interpretations are represented by formulae of TY2. We assume that every predicate of TY2 that represents a natural language predicate carries a world variable. Translations are set up in such a way that the world variable of the main predicate is the one abstracted over under embedding (while the world variable associated with the argument can be independently set – cf. Percus 2000). An example is provided in (1a).

- (1) a. I saw some boy $\rightarrow \lambda w \exists x \in D_w (\text{student}_w(x) \wedge \text{saw}_w(I, x))$
 b. $\lambda c. \|\lambda w \exists x \in D_w (\text{student}_w(x) \wedge \text{saw}_w(I, x))\|^c$

Strictly speaking, formulae such as the one in (1a) are short hands for functions over contexts of the form given in (1b). So a formula as in (1a) is actually to be understood as a function from

contexts into sets of worlds. Contexts include assignments to indexicals and to domain variables.

Since quantificational domains are the aspect of context most directly relevant to our concerns, I

will generally refer to (1) as functions from domains into propositions. I assume that formulae like

- (1) are used to increment common grounds, understood as sets of worlds (Stalnaker xx).

Intuitively, two formulae are $D(\text{omain})$ -variants iff they are alphabetic variants with respect to some domain variable. Here is a semantic characterization of this notion.

(2) D-variance.

- a. q is a D -variant of p (in symbols $D\text{-variant}(p,q)$), iff there are some i, j such that for every context c , and every domain D , $p(c[i/D]) = q(c[j/D])$
- b. For any p , we designate as $D\text{-variant}(p)$ the set of its D -variants.

In the representation language, we want to define both unrestricted and restricted (i.e. domain and world bound) quantification/abstraction. Let U be the domain of individuals and let the set of worlds W be a subset of U . Furthermore, let D be an arbitrary subset of U . For any world w , D_w is that subset of D containing all members of U existing in w .

(3) a. Unrestricted quantification.

i. $\|\exists x \phi\|^{w,g} = 1$ if for some u in U $\|\phi\|^{w,g[u/x]} = 1$

ii. $\|\exists x \phi\|^{w,g} = 0$ if for all u in U $\|\phi\|^{w,g[u/x]} = 0$

undefined, otherwise

b. Restricted quantification

i. $\|\exists x \in D_w \phi\|^g = 1$ if for some u such that $u \in \|D_w\|^g$, $\|\phi\|^{g[u/x]} = 1$

ii. $\|\exists x \in D_w \phi\|^{w,g} = 0$ if $\|D_w\|^g \neq \emptyset$ and for all $u \in \|D_w\|^g$, $\|\phi\|^{w,g[u/x]} = 0$
undefined, otherwise.

c. Restricted λ -abstraction

$\|\lambda x \in D_w . \phi\|^g = h$, where for every $u \in U$, if $\|D_w\|^g \neq \emptyset$ and $u \in \|D_w\|^g$, then

$h(u) = \|\phi\|^{g[x/u]}$; otherwise, $h(u)$ is undefined.

If ϕ_w is a formula whose “main” world variable is w , and R is an accessibility relation, then

we

express modalities as follows:

(4) Modalities.

a. $\forall w' R(w, w') \rightarrow \phi_w$, (abbreviated as $\forall_w \phi$)

b. $\exists w' R(w, w') \wedge \phi_w$, (abbreviated as $\exists_w \phi$)

Note that for $\forall_w \phi$ to be true, ϕ has to be undefined or true in every world accessible to

w ;

while for $\exists_w \phi$ to be true, ϕ has to true in some world accessible to w

We now turn a characterization of the structure of the lexical entries to be used in the recursive characterization of “strong meaning of α ”, for any expression α .

II. Lexicon.

We will consider two type of lexical entries that activate alternatives: scalar terms and polarity items. Let us start with scalar terms. For each *lexical* entry, we characterize its basic

meaning $\|\alpha\|$ and its alternatives $ALT(\alpha)$, by simply listing them. Here are some relevant examples.

- (1) $\|\text{some}_{[+Q]}\| = \lambda P \lambda Q \lambda w \text{ some}(P_w, Q_w) = \lambda P \lambda Q \lambda w \exists x [P_w(x) \wedge Q_w(x)]$
 $ALT(\text{some}_{[+Q]}) = ALT(\text{every}_{[+Q]}) = \dots =$

$$= \{ \lambda P \lambda Q \lambda w \text{ some}(P_w, Q_w), \dots, \lambda P \lambda Q \lambda w \text{ every}(P_w, Q_w) \}$$

Following Ionin and Matushansky xx, I assume that the basic type of numerals is $\langle \langle e, t \rangle, \langle e, t \rangle \rangle$. They also have a generalized quantifier version, obtained from the basic type via existential closure. Here is a simplified characterization of the basic version of numerals.

$$(2) \quad \text{||one}_{[+σ]}|| = \lambda P \lambda x \lambda w [1(x) \wedge P_w(x)]$$

$$\text{ALT}(\text{one}_{[+σ]}) = \text{ALT}(\text{two}_{[+σ]}) = \dots \{ \lambda P \lambda x \lambda w [1(x) \wedge P_w(x)], \lambda P \lambda x \lambda w [2(x) \wedge P_w(x)], \dots \}$$

Here is the generalized quantifier version of numerals.

$$(3) \quad \text{||one}_{[+σ]}|| = \lambda P \lambda Q \lambda w \exists x [1(x) \wedge P_w(x) \wedge Q_w(x)]$$

$$\text{ALT}(\text{one}_{[+σ]}) = \text{ALT}(\text{two}_{[+σ]}) = \dots$$

$$= \{ \lambda P \lambda Q \lambda w \exists x [1(x) \wedge P_w(x) \wedge Q_w(x)], \lambda P \lambda Q \lambda w \exists x [2(x) \wedge P_w(x) \wedge Q_w(x)], \dots \}$$

Let us assume the indefinite article *a* has the same meaning as *one*.

Turning to polarity items, negative polarity *any* can be treated in a manner analogous to *one*,

except that it does not impose any cardinality requirement on its argument. It binds the world

variable of its argument and it activates “large” sub-domain alternatives. Here is a possible way of ensuring this.

$$(4) \quad a. \text{||any}_{[+σ]}|| = \lambda P \lambda x x \in D_w \cdot \exists w' [P_{w'}(x)]$$

$$b. \text{ALT}(\text{any}_{[+σ]}) = \{ \lambda P \lambda x x \in D'_w \cdot \exists w' [P_{w'}(x)] : D' \subseteq D \text{ and } D' \text{ is large} \}$$

The entry in (a)-(b) has a generalized quantifier variant, obtained via \exists -closure:

$$c. \text{||any}_{[+σ]}|| = \lambda P \lambda Q \lambda w \exists x x \in D_w \exists w' [P_{w'}(x) \wedge Q_w(x)]$$

$$d. \text{ALT}(\text{any}_{[+σ]}) = \{ \lambda P \lambda Q \lambda w \exists x x \in D'_w \exists w' [P_{w'}(x) \wedge Q_w(x)] : D' \subseteq D \text{ and } D' \text{ is large} \}$$

Keep in mind that pure negative polarity *any* is a fiction. *Any* has, in fact, the FC implicature, so its interpretation is actually more similar to the one of *qualunque/qualsiasi* sketched below (modulo the fact that *qualunque* requires the stronger version of σ).

Let us now consider the FCI *qualsiasi*. *Qualsiasi* is an NP modifier; it binds the world variable of its argument; at the same time, it activates domain alternatives. Here is an example:

$$(5) \quad a. \text{||due}_{[+σ]} \text{ studenti qualsiasi}_{[+σ]}|| = \lambda Q \lambda w \exists x x \in D_w \cdot \exists w' [\text{student}_{w'}(x) \wedge 2(x) \wedge Q_w(x)]$$

‘two student whatever’

$$b. \text{||studente qualsiasi}_{[+σ]}|| = \lambda x x \in D_w \cdot \exists w' [\text{student}_{w'}(x)]$$

‘student whatever’

So the phrase *student whatever* denotes the property of being a possibile student in D. It combines with numerals in the usual manner. From this we conclude that the lexical entry for *qualsiasi* might be something like:

$$(6) \quad \text{||qualsiasi}_{[+σ]}|| = \lambda P \lambda x x \in D_w \cdot \exists w' [P_{w'}(x)]$$

$$\text{ALT}(\text{qualsiasi}_{[+σ]}) = \{ \lambda P \lambda x x \in D_w \cdot \exists w' [P_{w'}(x)] : D' \subseteq D \wedge D \cap \lambda x \exists w [P_w(x) \neq \emptyset] \}$$

For any lexical entry different from the above, we assume that the set of their lexical alternatives is empty.

- (7) For any lexical entry α different from the above, $ALT(\alpha) = \emptyset$

III. Simultaneous recursive characterization of $\|\alpha\|_s$ and $\|\alpha\|_s^{ALT}$.

To go on with our definition, we need to define two simple auxiliary notions. The first is a generalized operation of application which allows us to apply a set of functions to a set of arguments of the appropriate type. It is simply a pointwise generalization of functional application:

- (8) Generalized application:

If B is a set of functions and A a set of arguments of a type appropriate to the functions in B , then:

$$B(A) = \{ \beta(\alpha) : \beta \in B, \alpha \in A \}$$

The second auxiliary notion spells out when a set of meaning is (properly) scalar.

- (9) a. A set of meanings A is scalar iff there is a scale $\langle p_1 \subset \dots \subset p_n \rangle \subseteq A$ (where $\subset =$ asymmetrically entails).
 b. $p \in A$ is scalar in A iff there is a unique scale $S \subseteq A$, such that $p \in S$. If p is scalar in A , we designate its scale as $S_p(A)$.

c. $p, q \in A$ are scale mates in A (in symbols, $S-A(p, q)$) iff $S_p(A) = S_q(A)$.

The third auxiliary notion is a version of application that embodies the claim that SIs are dealt with cyclically (bottom up) and locally:

Finally, I am also going to adopt the following abbreviations:

- (10) a. $O_C(p) = p \wedge \forall q [C(q) \wedge q \rightarrow p \subseteq q]$
 b. $E_C(p) = p \wedge \forall q [C(q) \rightarrow p \subseteq q]$
 c. $O_C^-(p) = p \wedge \forall q \in C [q \rightarrow p^-]$

Throughout, $\|\alpha\|_s$ and $\|\alpha\|_s^{ALT}$ are the *smallest* sets of semantic values of the appropriate type that satisfy the following conditions that follow.

- (11) Base.

If α is lexical entry, then

$$11_s. \|\alpha\|_s = \{\|\alpha\|\}$$

$$11_{ALT}. \|\alpha\|_s^{ALT} = ALT(\alpha), \text{ if } \neq \emptyset, \|\alpha\|_s, \text{ otherwise}$$

- (12) Functional Application.

$$12_s. \|\alpha \beta\|_s = \begin{cases} \|\alpha\|_s (\|\beta\|_s), & \text{if } \beta \text{ is not DE} \\ \|\alpha\|_s (\|\beta\|), & \text{if } \|\beta\| \text{ is DE and } \beta \text{ contains no scalar term} \\ O_C \|\alpha\|_s (\|\beta\|), & \text{where } C = S_{\|\beta\|(\|\gamma\|)} (\|\alpha\|(\|\beta\|^{ALT})), \text{ otherwise} \end{cases}$$

$$12_{ALT}. \|\alpha \beta\|_s^{ALT} = \begin{cases} \text{APPLY}(\|\beta\|_s, \|\gamma\|_s), & \text{if } \|\beta\| \text{ is not DE} \end{cases}$$

$\{ O_C(\xi) : \text{where for some } \eta \in \|\beta \gamma\|_s, O_C(\xi) \text{ is a D-variant of } \eta \text{ and } C = S_\xi(\|\beta \gamma\|_s^{ALT}), \text{ otherwise}$

(13) Scalar enrichment

If $\|\alpha\|$ is of type t , then:

$$13_s. \|\alpha\|_s \supseteq \{ O_C(\xi) : \xi \in \|\alpha\|_s, C = S_\xi(\|\alpha\|_s^{ALT}) \}$$

$$13_{ALT}. \|\alpha\|_s^{ALT} = \{ O_C(\xi) : \text{where for some } \eta \in \|\alpha\|_s, O_C(\xi) \text{ is a D-variant of } \eta \text{ and } C = S_\xi(\|\alpha\|_s^{ALT}) \}$$

(14) Max Domain enrichment

If $\|\alpha\|$ is of type t and $\|\alpha\|_s^{ALT}$ doesn't contain small domains, then:

$$14_s. \|\alpha\|_s \supseteq \{ E_C(\xi) : \xi \in \|\alpha\|_s, C = \|\alpha\|_s^{ALT} \cap D\text{-variant}(\xi) \}$$

$$14_{ALT}. \|\alpha\|_s^{ALT} = \{ E_C(\xi) : \text{for some } \zeta \in \|\alpha\|_s, \xi \in S_\zeta(\|\alpha\|_s^{ALT}) \text{ and } C = \|\alpha\|_s^{ALT} \cap D\text{-variant}(\xi) \}$$

(15) Min Domain enrichment.

if $\|\alpha\|^{ALT}$ doesn't contain "small" domains;

$$15_s. \|\alpha\|_s \supseteq \{ O^-_C(\xi) : \xi \in \|\alpha\|_s, C = \|\alpha\|_s^{ALT} \cap D\text{-variant}(\xi) \}$$

$$15_{ALT}. \|\alpha\|_s^{ALT} = \{ O^-_C(\xi) : \text{for some } \zeta \in \|\alpha\|_s, \xi \in S_\zeta(\|\alpha\|_s^{ALT}) \text{ and } C = \|\alpha\|_s^{ALT} \cap D\text{-variant}(\xi) \}$$

Here is the definition of the σ -operator in its two forms.

$$(16) \quad a. \|\sigma \phi\| = \uparrow p[p \in \|\phi\|_s \wedge \forall q [\|\phi\|_s(q) \rightarrow p \subseteq q] \wedge p \neq \emptyset]$$

$$a'. \|\sigma \phi\|_s^{ALT} = \{ \uparrow p[p \in \|\phi\|_s \wedge \forall q [\|\phi\|_s(q) \rightarrow p \subseteq q] \wedge p \neq \emptyset] \}$$

$$b. \|\sigma \phi\| = \uparrow p[p \in \|\phi\|_s \wedge \forall q [\|\phi\|_s(q) \rightarrow p \subset q] \wedge p \neq \emptyset]$$

IV. Examples. MISSING

V. Gianni deve sposare un dottore qualsiasi ' John must marry a doctor whatever'

VI. Proof that $O(O^-(\exists x \in D_w \exists w'(\text{doctor}_w(x) \wedge I \text{ marry}_w x)))$ is incoherent

$$O^-(\exists x \in D_w \exists w'(\text{doctor}_w(x) \wedge I \text{ marry}_w x)) = \forall D(\exists x \in D_w \exists w'(\text{doctor}_w(x) \wedge I \text{ marry}_w x))$$

$$ALT(O^-(\exists x \in D_w \exists w'(\text{doctor}_w(x) \wedge I \text{ marry}_w x))) =$$

$$\{ O^-(\exists x \in D_w \exists w'(\text{doctor}_w(x) \wedge I \text{ marry}_w x)), \dots, O^-(\exists n x \in D_w \exists w'(\text{doctor}_w(x) \wedge I \text{ marry}_w x)), \dots \}$$

$$\text{But for } n > 1, O^-(\exists n x \in D_w \exists w'(\text{doctor}_w(x) \wedge I \text{ marry}_w x)) = \emptyset$$

This is so because $O^-(\exists n x \in D_w \exists w' (\text{doctor}_{w'}(x) \wedge I \text{ marry}_w x))$ requires that for every D containing a possible doctor, there must be n doctors, which is contradictory.

So (a) becomes $\{\emptyset, O^-(\exists x \in D_w \exists w' (\text{doctor}_{w'}(x) \wedge I \text{ marry}_w x))\}$

This is not a set of alternatives that any of the standard operations can apply to; accordingly it will be impossible to empty it.

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